The Electrical Industry's Weekly Magazine

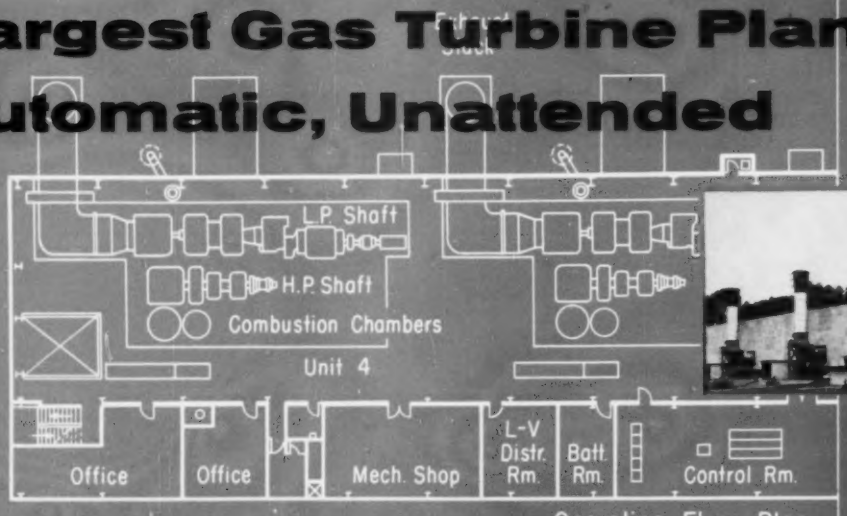
February 1, 1960

Electrical World

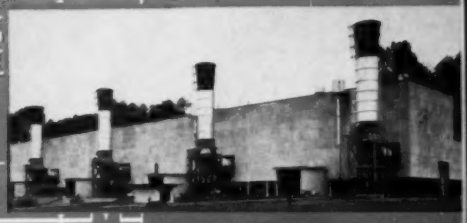
Price 50 Cents

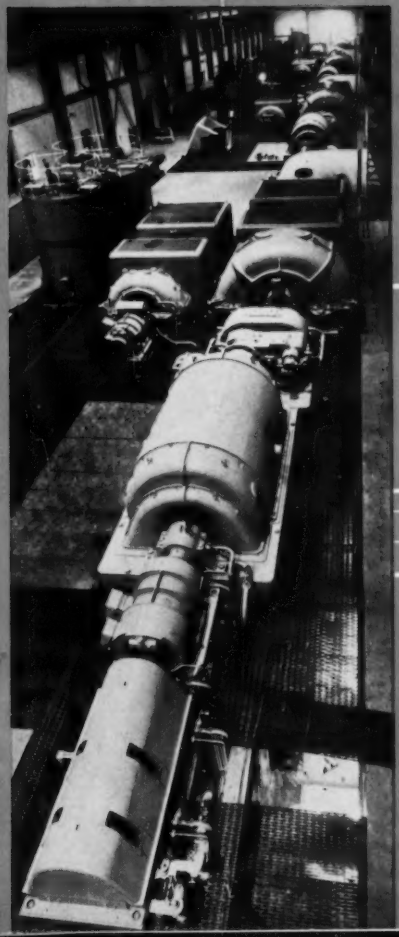
A McGraw-Hill Publication

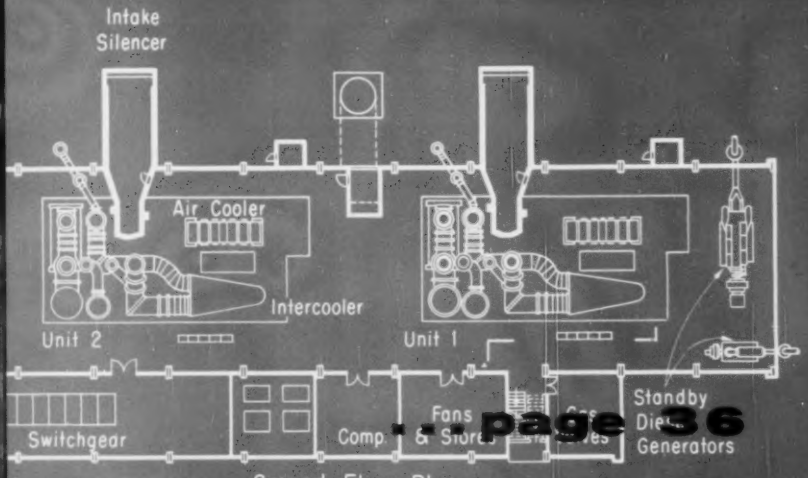
Largest Gas Turbine Plant Automatic, Unattended



Operating Floor Plan







Ground Floor Plan

page 36

Meanwhile, AEP and GE Plan . . .

New 5-Mw Gas Turbine to Burn C[illegible] p28

UNIV MICROFILMS INC
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21 Years Underground

—and still as good as new!

21 years ago, the **Niagara Mohawk Power Company** specified Burndy MOLEs for their underground modernization program. Specifications called for a connector that would perform without fault, under prolonged exposure to dampness, oils, extreme temperatures, and last the life of the cables connected. The MOLEs met all specifications, and are as good as new today ... proof beyond doubt that Burndy MOLEs have the high quality necessary for underground systems.

Utilities thruout the country have had similar long years of trouble-free experience with the MOLE ... experience that proves that the MOLE meets underground specifications for maximum dependability.

If you are considering "going underground", or expanding your present system don't take a chance on costly burnouts and disrupted service, call your local Burndy representative ... he has had years of underground experience and can help you get maximum dependability and flexibility in your underground system.

Photo from Niagara Mohawk Power's file, dated 1938, showing actual installation of MOLE in its underground system. These same MOLEs are in operation today, after 21 years of trouble-free performance.

BURNDY

59-19

ELECTRICAL CONNECTORS

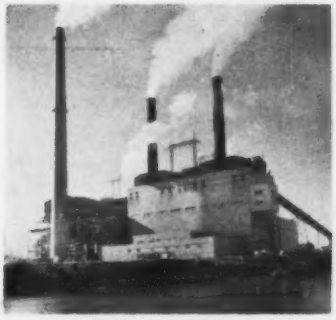
Norwalk, Connect. In Europe: Antwerp, Belgium Toronto, Canada

Electrical World

Vol. 153, No. 5 FEBRUARY 1, 1960

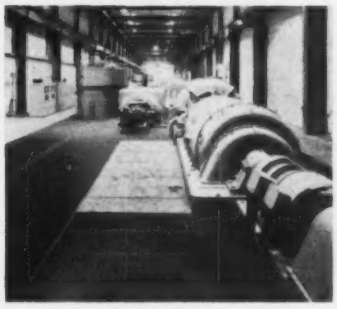
Published for 86 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue



p 28

p 40



p 36

CURRENT EVENTS

5-Mw Coal-Fired Gas Turbine Planned

Joint American Electric Power-General Electric project will be installed in Muskingum River plant.....p 28

New Features Keynote Appliance Show

A host of innovations is coming out as manufacturers strive to bolster their share of the replacement market....p 30

DISTRIBUTION

20/34.5-Kv Distribution Approved by Linemen

D. L. Andrews, Idaho Power Co

Crews like spacing, clearances, workability, ease in locating trouble on system grown to 300 miles.....p 40

GENERATION

Gas Turbine Plant Has 100-Mw Capacity

Dr T. Ingledow, B. C. Engineering Co

B. C. Electric's four-unit Port Mann Station is fully automatic and controlled from Vancouver 15 miles away.....p 36

TRANSMISSION

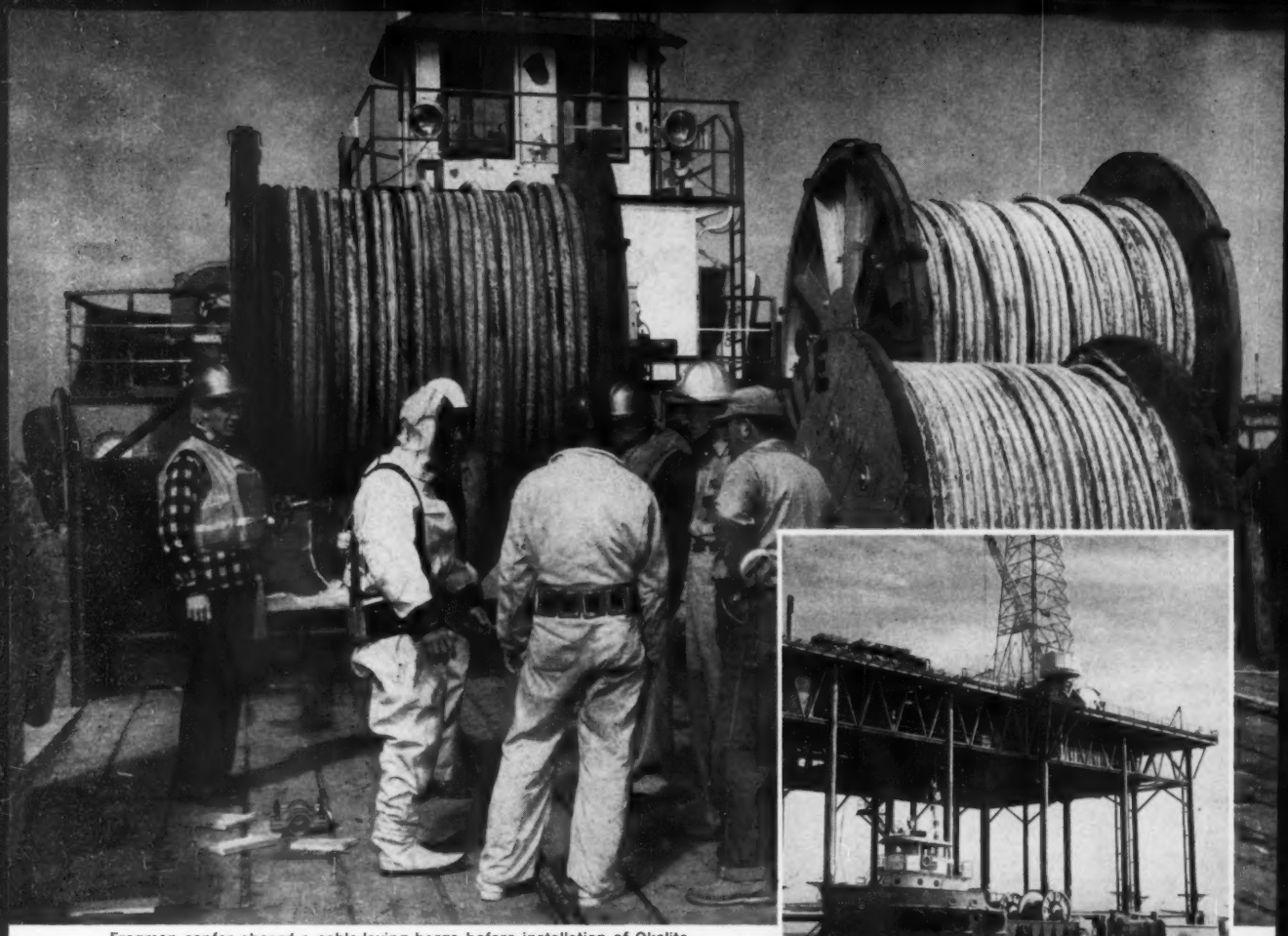
New 230-Kv Line Has Light Steel Towers

W. A. Boone, Fred E. Rogers, Alabama Power Co

20.6-miles section over rugged terrain, tying in SEGCO steam station, prompted redesigning many towers.....p 42

Departments

Editorial Comment 27	Manufacturers News 64	Politics and Public Power... 12
Electric Utility Methods.... 54	Meetings Calendar 78	Procurement & Products.... 63
Electrical Week 11	New Equipment 70	Readers Service 71
Letters 5	News About People 72	Selling 56
Management Newsletter ... 59	Nuclear Notes 14	INDEX TO ADVERTISERS... 78



Frogmen confer aboard a cable-laying barge before installation of Okolite-Okoprene 5 Kv underwater power and Okolene supervisory control cables at Freeport Sulphur's off-shore sulphur mine in the Gulf of Mexico. These armored cables carry power and control circuits for the auxiliary drilling platform, where water is removed from sulphur deposits.

The cable-laying barge moves past part of the Freeport Sulphur installation, "the world's largest steel island," where Okolite-Okoprene and Okolene-insulated cable were specified by company engineers for critical underwater circuits.

Freeport Sulphur chooses Okonite electrical cables for world's first off-shore sulphur mine

As in other installations where circuit security is a *must*, Freeport Sulphur engineers chose Okonite submarine power, communication and control cables for underwater circuits to the auxiliary drilling platform which makes possible continuous production at the company's giant, off-shore sulphur mine—first in the world—in the Gulf of Mexico.

Located 2,000 feet from the main structure, the auxiliary platform has a number of wells which remove the excess water from the deposit. The platform houses giant pumps and mixers for the safe disposal of this water.

Two armored three-conductor Okolite-Okoprene 5 Kv submarine cables and one armored 100-conductor Okolene-insulated cable carry all power, communication and supervisory control circuits to the isolated auxiliary platform, enabling control of all equipment from the main platform. In addition, an unarmored 100-conductor Okolene-insulated cable carries control and communication circuits for the main drilling platform from the control house.

Okonite cables were specified for the underwater task, Freeport engineers say, because of their past performance in other important jobs.

Okonite has a cable, too, for *your* circuits that must not fail. For information on the right cable for the right job, ask your Okonite representative or write for free Bulletin EW-1117, "How To Choose Insulated Cable," to The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, N. J.

7295

where there's electrical power . . . there's **OKONITE CABLE**

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LETTERS

230 Kv Useful and Economic

To the Editor:

I have read with great interest the article in the November 30, 1959 issue of Electrical World, "Utilities Offer 230-Kv Plan for Five-State Rocky Mountain Area."

Considering the geography of the United States, the population growth and distribution, and the activities, I have long ago come to the conclusion that 230 kv would continue to play a major role, in time to come, as a power transmission and distribution voltage. In this connection, you may recall that I endeavored to make this clear and emphasized the role and place of 230 kv in the last several paragraphs of the article in the Dec. 1, 1952 issue (p 84).

The recent article just shows that 230 kv is extremely useful and economic in many important situations.

Peter L. Bellaschi
Consulting Engineer
7417 SE Yamhill St.
Portland 15, Ore.

Points Up Needs for Adequate Return

To the Editor:

I thought you might like to know that we thought so well of the "Value of Profits" piece in the Nov. 30 issue that we would like to make some reprints and call it to the particular attention of all of our supervisory people.

It is a fine discussion of the subject and should be very helpful in strengthening the understanding of the need for an adequate return on the Company's investment. The subsequent articles on the same subject will also be called to the attention of the same group.

John Dierdorff, vice president
Pacific Power & Light Co
Portland 4, Ore.

Comment on Barnyard Noise

►In a letter printed in our Jan. 4 issue, page 64, Reader Earl L. Phillips accused us of occasionally "squeal(ing) like a first bred sow." The phrase brings this pertinent comment from another reader:

To the Editor:

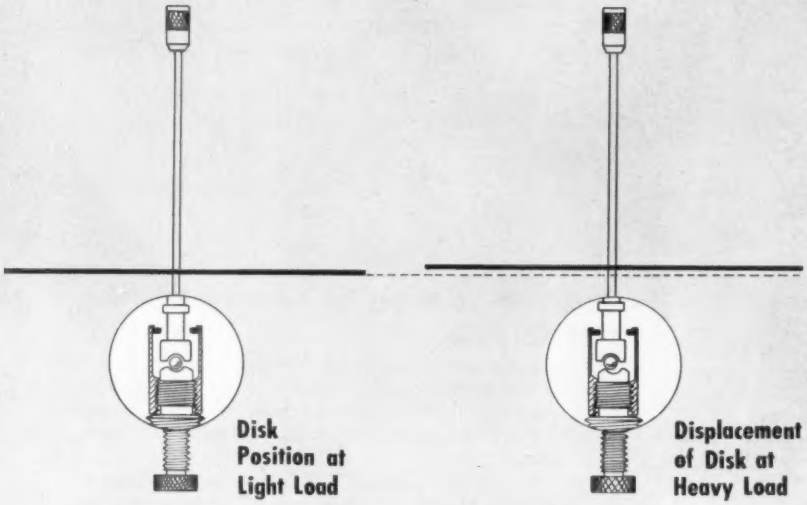
Mr. Phillips' letter leads me to believe that I lived a somewhat sheltered 20 years on my father's farm because I cannot seem to recall the tonal qualities that distinguish the squeal of a first bred sow.

However, I am happy that you printed his letter as I found it very amusing.

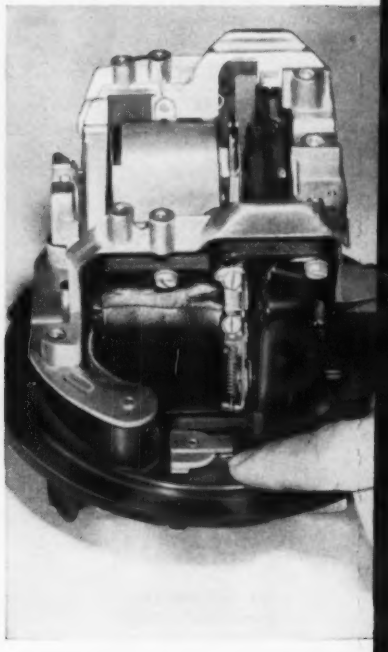
Ed Wiens
1001 Harriet Ave.
Minneapolis 20, Minn.

5 WAYS

Here's Why General Electric's New, Complete



OLD-STYLE BALL-BEARING SYSTEM



1 **MAGNETIC SUSPENSION ASSURES ACCURACY THROUGH FULL METER RANGE**—With conventional ball and jewel bearing system, higher loads can force the disk out of position and cause inaccurate meter readings. Because the disk in General Electric polyphase meters floats free, there's never a danger of disk displacement at any load . . . meter readings are accurate through full meter range.

In addition, because there are no ball bearings in G-E's magnetic suspension system, you eliminate bearing inspection, cleaning and replacement costs. You also minimize revenue losses because this free-floating system reduces friction-caused tilt errors.

2 **COORDINATED INSULATION SYSTEM PROVIDES MAXIMUM SURGE PROTECTION**—Exclusive series gap design, with magnetic blowout, offers best protection against lightning and other surges. Flashover is controlled and the resulting arcs extinguished within ½-cycle by this unique gap design.

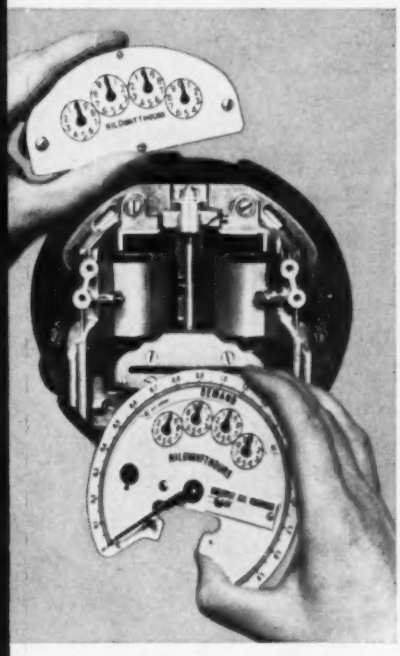
THESE FIVE EXCLUSIVE FEATURES, together with unexcelled load and power factor performance, combine to make the General Electric V-60's your best meter buy.

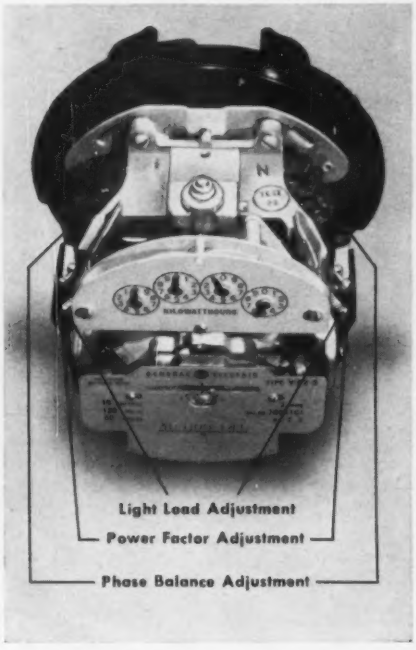
There's a G-E V-60 meter to handle every Class 10, 100 or 200 two-stator polyphase application. Depending upon your needs, specify the V-62 (network and 3-wire, 3-phase), V-63 (3-wire, 3-phase), V-65 (4-wire Y, 3-phase), or the V-66 (4-wire △, 3-phase).

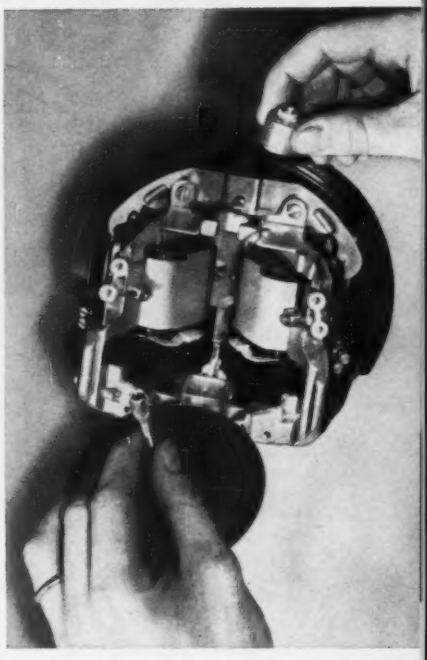
FOR COMPLETE INFORMATION on G-E's new V-60 polyphase meter line, contact your nearest G-E apparatus sales representative or write General Electric Company, Section 628-28, Schenectady 5, N. Y.

BETTER

V-60 Polyphase Meter Line Is Your Best Buy!







3 NEW POLYPHASE METER LINE GIVES YOU GREATER VERSATILITY – V-60 meters accommodate either kilowatt-hour or demand registers without use of adaptors or intermediate gearing. Any G-E demand register manufactured in the last ten years can be used on V-60's as well as on any other G-E meter.

4 ONLY V-60 METERS OFFER COMPLETE, INDIVIDUAL STATOR ADJUSTMENTS—General Electric's advanced V-60 design provides complete vernier adjustments on each stator for all polyphase load conditions. Meters you receive are precisely calibrated for optimum performance. Only one of the light load adjustments is required for normal calibration "touch-up."

5 EXCLUSIVE "V" STATOR DESIGN SIMPLIFIES FIELD MODIFICATION—Because of G-E's unique "V" stator design, disk and shaft assembly can be removed to accommodate contact devices and detents without disassembling meter. Precisely doweled magnet location eliminates need for recalibration.

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US RUBBER TAPES

The Splice is always right

U. S. GRAY PERFECTION TAPE

Made of the strongest fabric, impregnated in every fiber with pure rubber. This U.S. Rubber method of manufacturing eliminates pinholes. The tape has the strongest adhesion. U.S. Gray Perfection Tape will not dry out. Here is a tape that not only meets specifications, but exceeds them.

United States Rubber produces tape for every insulation and splicing need. "U.S." engineers know exactly what is required of any splicing compound, whatever the application. Simplify your purchasing by ordering from *one* line — the "U.S." line. Get in touch with any of our numerous distributors or one of our strategically located Branch Sales Offices, or write to address below.

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Uskorona combines maximum resistance to OZONE and MOISTURE with high tensile strength, elongation and dielectric resistance. Fuses quickly without heat or pressure and makes
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SPLICES
Made in U.S.A.
UNITED STATES RUBBER CO. PASSAIC, N.J.

USKORONA® SPLICING COMPOUND

This is the ozone- and moisture-resistant tape for overhead splicing where high dielectric protection is needed. Uskorona fuses quickly without heat or pressure and makes the splice an inseparable part of the original insulation. Uskorona is superior in tensile strength, durability and moisture absorption. Use the time-proven Uskorona splicing compound—and be *sure*.

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FEDERAL PACIFIC FUSEMATIC*

A NEW CONCEPT IN RELIABLE LOW COST CIRCUIT PROTECTION

Now 200,000 amp interrupting capacity breaker at low cost! Fusematic combines a low voltage power circuit breaker with coordinated current limiting fuses in an integral unit. This combination gives you a 600 volt, 1600 ampere breaker with 200,000 amp interrupting capacity. Lower fault current and faster interruption mean improved short circuit protection plus reduced maintenance expenses at substantially lower initial cost.

SAFE. Can close against faults up to 200,000 a.

ECONOMICAL. Current limiting fuses reduce possible fault current permitting use of smaller frame size circuit breakers.

COMPACT. Only 24″ wide by 22½″ high. Units stack four high in 90″ enclosure.

VERSATILE. Available in manual or electrical operation, fixed or drawout mountings for both indoor or outdoor construction.

PROVIDES SINGLE PHASE PROTECTION.

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*Trademark

FPE

FEDERAL PACIFIC ELECTRIC COMPANY

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The Electrical Week

LATE NEWS ▶ **Around the States . . .** California Gov "Pat" Brown hires consulting firm to study "a truly adequate" EHV interconnection between Bonneville and the Central Valley Project . . . Illinois Supreme Court, in water-company case, orders anyone using liberalized depreciation to use flow-through method. This is a reversal of the commission's position . . . 14th Florida Electrical Exposition, sponsored by Tampa Electric, to be opened Feb. 2-13 . . . Georgia Power to build $76-million, two-unit, 500-Mw plant near Atlanta.

Recent Russian plan calls for USSR to overtake U.S. by 1975 in gross electric power production. Plan says USSR will be producing 1,500 billion kwhr. At that time, U.S. estimates put us at 2,000 billion kwhr.

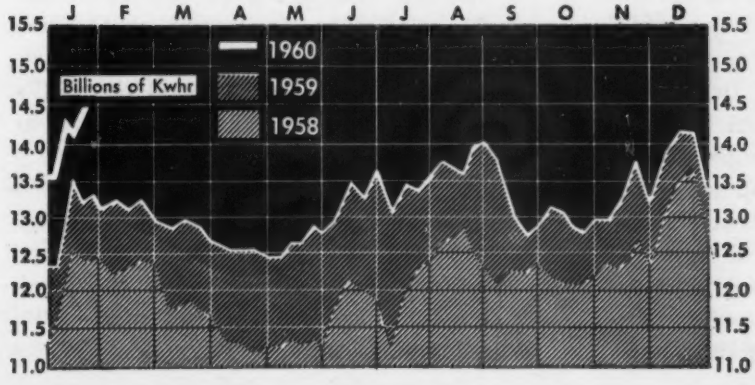
EEI to make study of direct conversion of energy to electricity. The one-year study will attempt to evaluate various methods of direct conversion as means for the bulk production of power.

Manufacturers News . . . Westinghouse reports 1959 billings of $1,910,730,000, an increase of 1% over '58. Net income, including a special tax refund, was $85,947,000, equal to $4.86 per share of common (before the recent 2-1 split). 1958 earnings were $4.25 a share . . . S&C Electric announces today a new interrupting device called a "circuit switcher." It's rated from 23 to 138 kv.

TVA won't sell power to Memphis unless the city buys all its needs from the authority, Chairman H. D. Vogel tells Memphis City Commissioner W. W. Farris in a letter. Farris wanted to know whether TVA power would be available after the city-owned plant reaches capacity, rather than adding another (fourth) generator to the plant.

Management changes . . . R. W. Call elected president of Missouri Utilities Co. T. F. Waltz is new vp . . . Appalachian Power elects R. E. Hodges vp.

WEEKLY POWER OUTPUT—Up 8.4% (Week ending Jan. 23), Kwhr 14,523,000,000



Per Cent Change From Previous Year

	Jan. 9	Jan. 16	Jan. 23
Total U. S.	+ 5.6	+ 6.8	+ 8.4
New Eng.	+ 1.5	+ 5.8	+ 5.0
Mid. Atlan.	+ 6.0	+ 7.8	+ 7.6
Cent. Ind.	+ 7.1	+ 8.4	+ 9.1
West Cent.	+ 3.1	+ 5.7	+ 4.4
Southeast	+ 3.1	— 1.1	+ 7.7
South Cent.	+ 6.7	+ 8.2	+ 8.1
Rocky Mount	+ 2.6	+ 9.2	+ 9.1
Pacific			
NW	+ 2.1	+11.3	+13.1
SW	+14.5	+18.4	+11.7

Seasonally Adjusted Index 266.1

Week Ago 260.9 Year Ago 245.5

Source: Edison Electric Institute

Preview of This Issue

EVENTS ▸ **American Electric Power will install a turbine which burns coal gas** at the Muskingum River Plant of Ohio Power Co. The 5,000-kw prototype, to be operating early next year, will be part of a combined cycle with one of the plant's four 215,000-kw steam turbines **(p 28)** . . . EEI report to Sen Kerr's Water Resources Committee sees future needs being met primarily by thermal generation **(p 29)** . . . The highlights of this year's appliance show appear on **page 30** . . . Ohio municipals study possibilities of a grid **(p 32)** . . . Westinghouse to spend $3 million on total electric home in 1960 **(p 34).**

ENGINEERING ▸ **Need room for a new unit in an existing station?** Read about how Commonwealth Ed side-mounted a two-shell condenser and then put the feed water heaters on top of it to make room for a new 325-Mw cross-compound unit at its Crawford Station **(p 35)** . . . A 100-Mw gas turbine plant, fully automatic and remote controlled, will firm up British Columbia Electric's predominantly hydro system **(p 36)** . . . Linemen like the workability of Idaho Power's 20/34.5-kv distribution, especially its spacing, clearance and ease of locating trouble **(p 40)** . . . New 230-kv transmission line for a rugged 20.6-mile stretch compelled Alabama Power to design new lightweight steel towers **(p 42).**

Politics and Public Power

IMPLICATIONS OF A NEW ARGUMENT

Federal power advocates are coming up with a new argument which, if it gains a foothold in Congress and the White House, will have implications for everything from the private-vs-public power fight to the country's economic competition with the Soviet Union.

The argument is simply this: That the nation's hydro power potential is not being accurately determined . . . and, as a logical consequence, it is not being fully developed.

Estimates of hydro potential are too low, so the charge is made. Thus our sights are set too low for future hydro development—and present hydro-development percentages appear to be greater than they should be.

The American Public Power Assn has made this charge in a special 39-page report to the Kerr Water Resources Committee. (See page 29 for a rundown on EEI report to the same committee.) "Greater boldness in estimating future power and water requirements" is needed, says APPA, plus a recognition of the fact that present estimates of U.S. hydro potential are "on the conservative side."

"To the extent that water resource planning is based upon unrealistically low estimates of future power use, it will fall short of meeting the needs of the American people," APPA warns. It adds that "giant strides in technology are constantly increasing the nation's hydro capacity, and the FPC's projections for future additions appear to be too low."

While APPA was issuing its warning, Bruce Netschert of Resources for the Future was telling the same story to the Electric Consumers Information Committee meeting in Washington last week.

PROCUREMENT & PRODUCTS ▶ **Copper production estimated to go up 16%** . . . Indiana Electric Assn launches fly-ash project . . . Strike at Pennsylvania Transformer ends (p 63) . . . Worthington Corp to hold series of nationwide steam power symposiums . . . Westinghouse and Alcoa develop new silicon rectifier (p 64) . . . Automatic switch transfer mechanism has been developed with dual cylinder activated by stored energy (p 70) . . . Aerial ladder features simplified design which reduces initial cost, installation expense, and upkeep (p 71).

MANAGEMENT ▶ **Are stock subscription "rights" wrong?** You'll find plenty of experts who can "prove" they are, and probably just as many who can "prove" otherwise. For an accurate analysis you have to balance many interests —the company doing the issuing, the stockholders, and the underwriters, securities dealers and brokers who distribute the issue. For details in this controversial, interesting question, turn to **page 59.**

SELLING ▶ **Home service women earn 70% of residential revenue.** This, among other things, is what the LBE Women's Conference is told **(p 56).**

NEXT WEEK ▶ **Look for a rundown of National Electrical Week activities** of both utilities and manufacturers for ideas you may be able to use yourself.

Netschert agrees with APPA that FPC estimates are on the low side, and "what we really need is a comprehensive survey of hydro resources of this country at the theoretical potential"—above and beyond what is economically feasible now.

What Netschert and APPA have in mind is another Paley Commission-type report on resources. Such a report, of course, could be done by the federal-power promoted "Joint Committee on Resources" or a White House "Resources Council," proposed in Sen Murray's bill (S-2549), now being debated.

Also, the possibility that the U.S. has greater hydro potential than previously predicted could throw an entirely different light on both sides of the question of whether or not "We are losing the world hydro-electric lead to the Soviet Union." If the premise is accepted that we do have more hydro potential than we thought previously, then it's a short distance to the position that it ought to be developed. This, in turn, gives the federal power advocates a new lease on life.

The whipping boy in this issue, of course, is the FPC, which prepares the only "authoritative estimate" on hydro potential. Netschert hits the latest FPC (Jan. 1959) figure of 121.8 million kw for being labelled "hydroelectric power resources." He says it is not what FPC says it is, but merely an incomplete total of data available, and not consistent at that. Netschert wants all hydro sites—even those not presently economically feasible—included on the grounds that some day they will be so.

This, then, may be a sign of things to come from federal power advocates. It makes an interesting argument. It will be equally interesting to see how and when it is countered.

Nuclear Notes

Electricite de France has confirmed intention to build a 150-Mw reactor in partnership with the Belgians. Choice has narrowed down to the PWR proposed by Franatome (Westinghouse) or the GE-Alsthom BWR proposal. The Atomics International OMR proposal is reported pigeonholed because the German AKS group planned the same type. But if the German reactor plan falls through, EDF may reconsider.

Hearing has been set for Feb. 23 on the Carolinas Virginia reactor construction permit. Major construction work on the 60,500-tkw vertical pressure-tube reactor project is expected to begin early in 1960 and be completed in mid-1962. Steam produced by the nuclear plant will be purchased by South Carolina G&E Co for use in its adjacent steam power plant. The reactor will be designed by Westinghouse, and the non-nuclear portion will be built by Stone & Webster for Carolinas Virginia Nuclear Power Associates.

The Homogeneous Reactor Experiment No. 2 at Oak Ridge National Laboratory has operated for 100 consecutive days in its most recent test, which is continuing. Described as "one of the most advanced and difficult experiments in the world's nuclear power effort," this operation shows that liquid fuel reactors can be successful and can operate with a continuity approaching that required for a practical larger nuclear power plant. In the HRE-2 uranyl sulfate fuel solution is pumped at high temperature and pressure through a spherical core vessel.

The Saxton nuclear reactor soon to be built by General Public Utilities will be used by the Pennsylvania State University for research and instruction. The university has agreed to become a participating, but non-paying, member of the Saxton Nuclear Experiment Corp. . . . "participation by the university in the activities of the corporation will be in direct keeping with our objectives of advancing the art of generating electric power by nuclear means," said Louis H. Roddis, chairman.

Purdue University has announced organization of a Department of Nuclear Engineering and appointed Dr Philip N. Powers, head of Internuclear Co of Clayton, Mo., as professor of nuclear engineering and head of the department. He will assume his duties March 1.

Formation of a joint company to design, build and market nuclear reactors in France has been decided upon by Atomics International, Societe Alsacienne de Construction Mecaniques and Chantiers de L'Atlantique. It will be called Dynaton and will build power and research reactors with special emphasis on sodium graphite and organic-cooled power types and solution type research reactors. First action, pending formation of the company, is a proposal for a 165-Mw OMR plant for Societe Franco-Belge de la Centrale Nuclaire des Ardennes, which is being formed by a group of French and Belgian utility companies.

Here are some plain facts about Intermediate Class Thorex Dynagap lightning arresters.

Compared to published industry maximums for the most costly heavy-duty Station Class arresters of only two or three years ago, the present Type GP (Intermediate) Thorex averages 35 per cent lower IR discharge voltage . . . a 35-per cent better arrester than money could buy in only 1958. Currently, it comes within just a few per cent of meeting the sharply-revised new industry maximums for heavy-duty Station Class IR discharge voltages.

In low-current, long-duration durability, the Thorex Intermediate arrester exceeds by over three times the present ASA Standard for heavy-duty Station Class.

These arresters cost less than half the price of corresponding Station Class models.

If your protective needs are high, and your budget low, you can buy the most protection per dollar with Thorex Dynagap Type GP arresters. Published information will confirm this if you care to run-down the data. Otherwise, simply install them . . . with confidence.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass HOLAN

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BUSHINGS · HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES · BRONZE VALVES

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O-B Bushings
use thick,
cast bronze
reservoirs
to resist
power arcs

Husky... where it's needed

In the life of any bushing the day might come for its oil expansion reservoir to serve as the terminal for a blazing power arc. This takes a husky piece of metal.

O-B bushing reservoirs are thick, cast bronze. They are purposely heavied-up at the striking point of a flashover. Danger of burning through the reservoir, damaging the bushing and releasing the oil, is minimized.

There may be cheaper ways of forming an oil expansion reservoir, but in 50 years of bushing experience we haven't found a *better one!*

We join you in hoping you will never discover this example of O-B superiority . . . but it's there if you need it. So are many other good construction features based on long association with field requirements.

There is a lot to your advantage in exploiting O-B's mature engineering, combined with modern design and the newest of manufacturing and inspection equipment. They add up to the most dependable bushing your money will buy.

. . . and it's all as easy to get as writing "O-B bushings" on your new transformer and circuit breaker orders.

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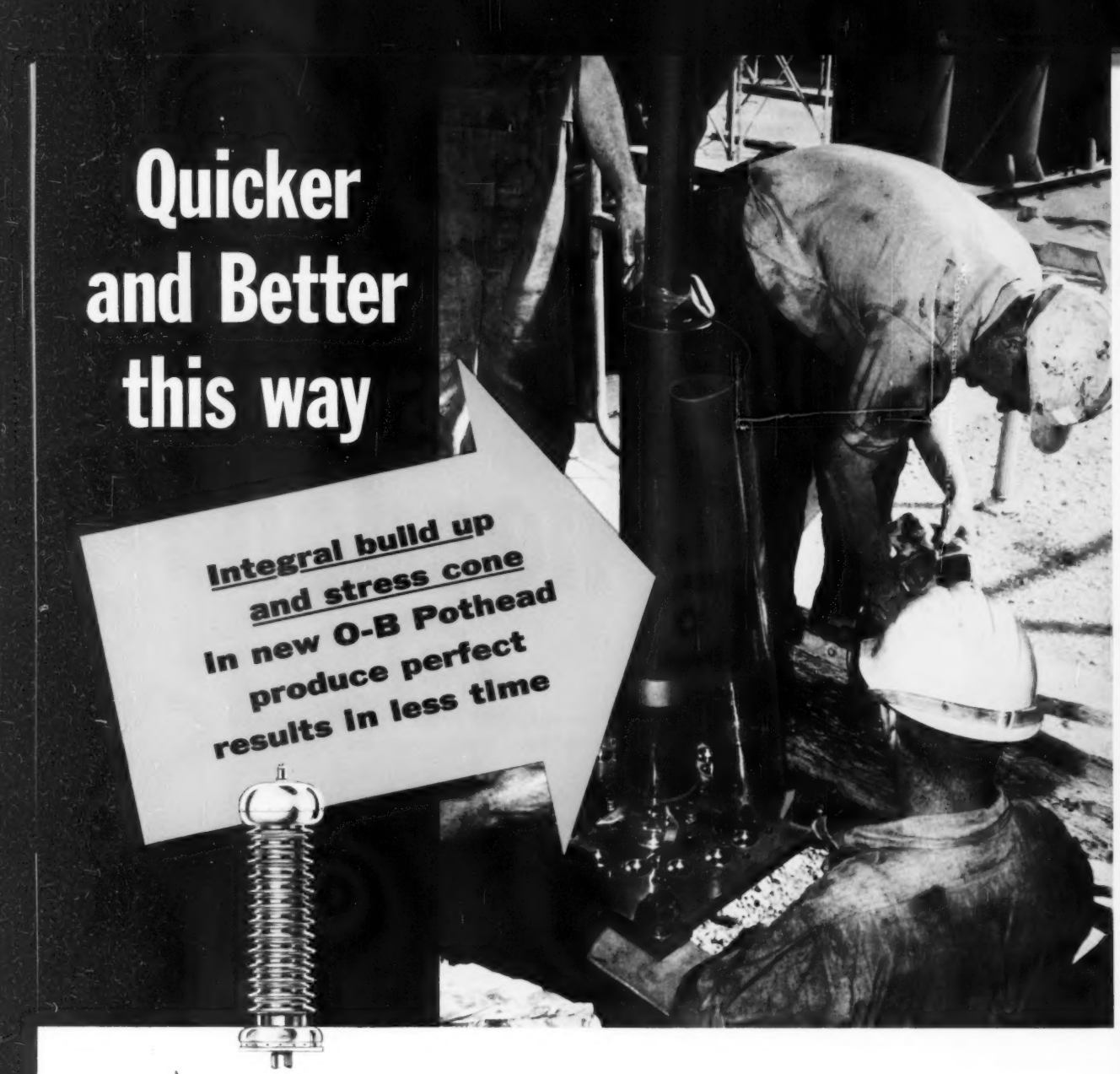

Integral build up and stress cone in new O-B Pothead produce perfect results in less time

These men are installing the lower paper buildup of a new 230-kv O-B capacitor-graded pothead. See the band on the lower end . . . this is the stress cone. The two are integral. A perfectly-formed stress cone is now merely a by-product of installing the buildup.

At the factory, a foil ribbon is firmly attached to the surface of the paper. By varying the angle slightly, a true logarithmic flare is imparted when the paper is wrapped into a tube. Much time is saved. Better results are achieved.

Ingenious design of the new O-B pothead has moved many critical operations from the field to the factory . . . where they belong. Not only does this assure a more precise end-result, but it permits easy installation in an ordinary working day. Thus cable exposure is reduced to a minimum.

Present production of O-B capacitor-graded potheads is in the range of 115-230 kv, inclusive, for all types of underground cable. If your plans involve such systems, investigate this newest development in terminal equipment.

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News about

B.F.Goodrich Chemical *raw materials*

HOW TO GET BETTER INSULATION FOR TELEPHONE DISTRIBUTION WIRE

INSIST ON GEON 8803

Bell, REA and other independent testing organizations agree on the high quality of insulation you get when conductors are insulated with Geon polyvinyl material.

Geon provides superior electrical properties, as well as excellent resistance to abrasion and weathering. Even total immersion in water or oil for years can't break down Geon materials.

In addition, wires insulated with Geon can cut hook-up costs as much as 50%. Since this insulating material can easily be color-coded, it is easy for installers to tap into the right line anywhere along the system.

Insulating distribution wire is only one of the many places where Geon provides superior service for the electrical and telephone industry. Geon also provides excellent pipe, conduit and coatings for many products. For more information about Geon 8803 or any of the many forms in which Geon can be used, write Dept. GX-2, B.F.Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable: Goodchemco. In Canada: Kitchener, Ontario.

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GEON vinyls • HYCAR rubber and latex • GOOD-RITE chemicals and plasticizers

STEAM TURBINE-GENERATORS

By N. K. Halsteen, Project Engineer, Brown Boveri Corp.

BROWN BOVERI

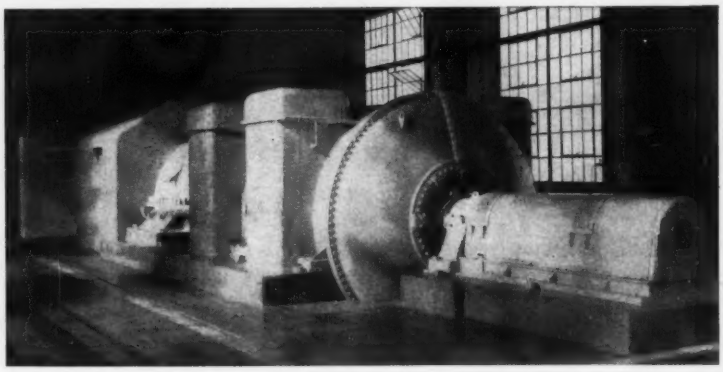
In 1901, Brown Boveri built the first steam turbine installed on the European continent. This turbine was also the world's largest. Since then, the company has made many basic contributions to turbine design and has built more than 5300 steam turbines for generating electric power and for driving blowers and compressors.

Brown Boveri steam turbine-generators include these types and sizes:

Condensing units offer highest efficiency, lowest steam consumption. All ASME Preferred Standard sizes. Single-shaft units to 350 mw. Cross-compound units to 500 mw and up.

Back-pressure units are rated at 500 to 30,000 kw and supply exhaust steam at 20 to 350 psia for low-pressure condensing units or for process.

Extraction-condensing units are rated at 1000 to 100,000 kw. Extraction steam at 7 to 15 psia is used for process and for heating water in municipal heating systems.

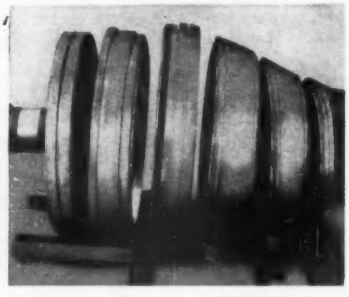


A Brown Boveri 30/33 mw Preferred Standard unit at Greenwood Mills, S. C.

Sectional rotors

Brown Boveri turbine rotors are made of forged sections welded together at the rims. This construction offers advantages over one-piece rotors: The relatively small size of each section ensures a more uniform forging and allows more thorough inspection. Sections with flaws are rejected and replaced virtually eliminating patching often required to salvage large one-piece forgings.

Asymmetries are cancelled out by the random positioning of adjacent sections. The low weight of a hollow, sectional rotor provides fast warm-up and rapid, uniform heat distribution in service. The sectional design eliminates axial stresses. Completed rotors are given ultrasonic tests and stress-relieving heat treatment. *No explosions or other serious failures have ever been experienced with Brown Boveri sectional rotors.*



Sections of a steam turbine rotor before welding. Welding is done automatically by an inert-gas process.

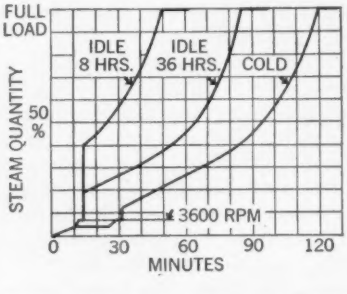
Hydraulic governing system

The Brown Boveri all-hydraulic, governing system uses no mechanical links and thus eliminates joint play or thermal expansion of links which may cause "hunting." Synchronization is quick, simple. On high-temperature reheat units, the governing system is separate from the lubricating oil system and uses a non-combustible fluid.

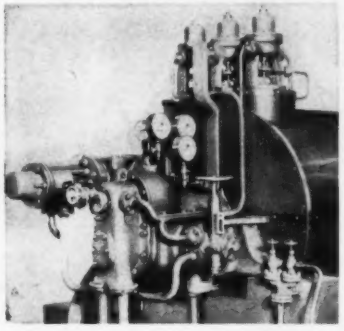
Fast start-up, flexible loading

The low weight of the rotor, lightweight casings and special flange-heating systems reduce temperature differences in the machine to a minimum . . . allowing fast and cold starts, fast changes in load and fast shut-downs without dangerous expansion differentials. Close radial tolerances can be maintained.

These advantages, together with simple synchronizing, are particularly useful where frequent start-ups are required . . . as for peaking.



Starting schedules for a large multi-cylinder reheat turbine . . . illustrating how quickly temperatures in the machine are equalized.



Brown Boveri linkage-free pressure oil governing system. Turbine may also be started and shut down with a single handwheel.

Service

Brown Boveri maintains installation crews and service shops in the U. S. and Canada . . . also working agreements with Todd Shipyard Corp. and National Electric Coil Co. whose shops can rebuild or repair the largest turbines and generators now in use and who have an outstanding record for fast, efficient service.

BROWN BOVERI

Brown Boveri Corp., Dept. PE2, 19 Rector Street, New York 6, N. Y. Agents in 27 U. S. cities.

Connect
COPPER with COPPER
ALUMINUM with ALUMINUM
use...

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ACSR 6—1/0 Cu. 8—1/0

PAC-3
ACSR 8—2 Cu. 8—2

PAC-4
(formerly PAC 6—0)
ACSR 6—1 0 Cu. 6—2

PAC-7 (replaces PARC 6—0)
ACSR 1 0—336.4 / 6—1 0 A R Cu. 8—1 0

BLACKBURN COPPER TO ALUMINUM FITTINGS

BLACKBURN PAC CLAMPS

ELIMINATE CORROSIVE SOLDERS, VOIDS AND FLUXES !

There are many satisfactory copper connectors for connecting copper conductors.

There are many satisfactory aluminum connectors for connecting aluminum conductors.

Blackburn's PAC clamps combine the features of a good copper connector and a good aluminum connector to give you the best copper to aluminum connector available.

Our exclusive method (Patent applied for) of pressure casting molten corrosion resistant aluminum alloy around specially treated pronged copper liners establishes an intimate, low resistance contact of the two metals without using corrosive solder.

The copper liners, which cannot be mated incorrectly, surround the copper conductor establishing a good copper to copper contact.

The aluminum grooves surround the aluminum conductors, establishing a good aluminum contact.

Adequate contact surface and conductor separation is built into Blackburn's PAC clamps to insure long-lasting, trouble-free copper to aluminum connections without setting up cold flow or galvanic corrosion.

Spring action is inherent in the design of PAC clamps and is supplemented with an extra-heavy spring lockwasher insuring permanently tight connections which will withstand temperature fluctuations.

Hot dipped galvanized steel hardware is standard. Aluminum hardware available on all but Catalog #PAC-3.

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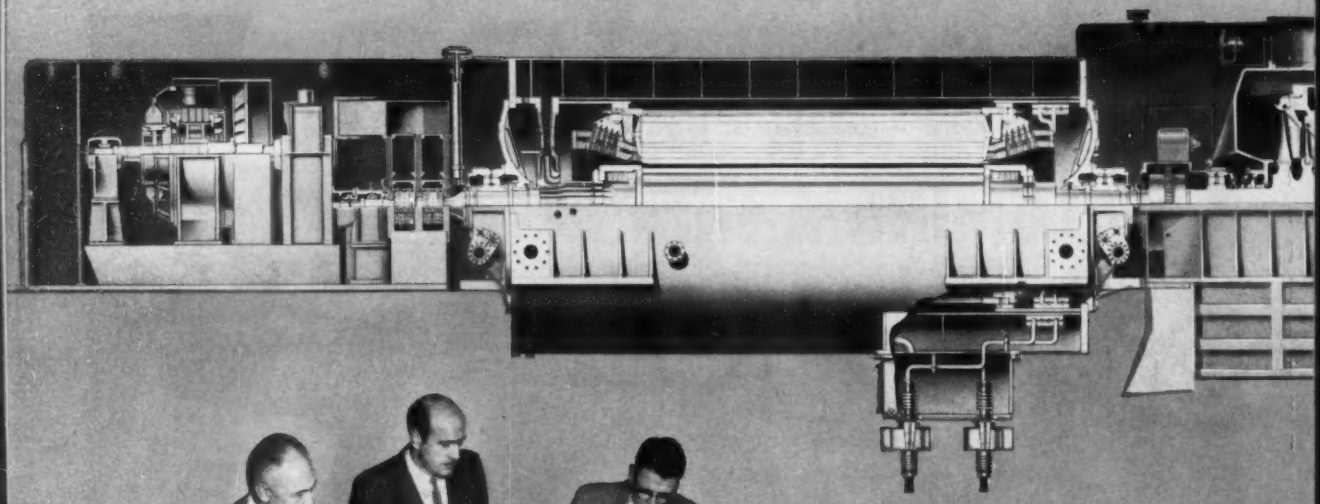


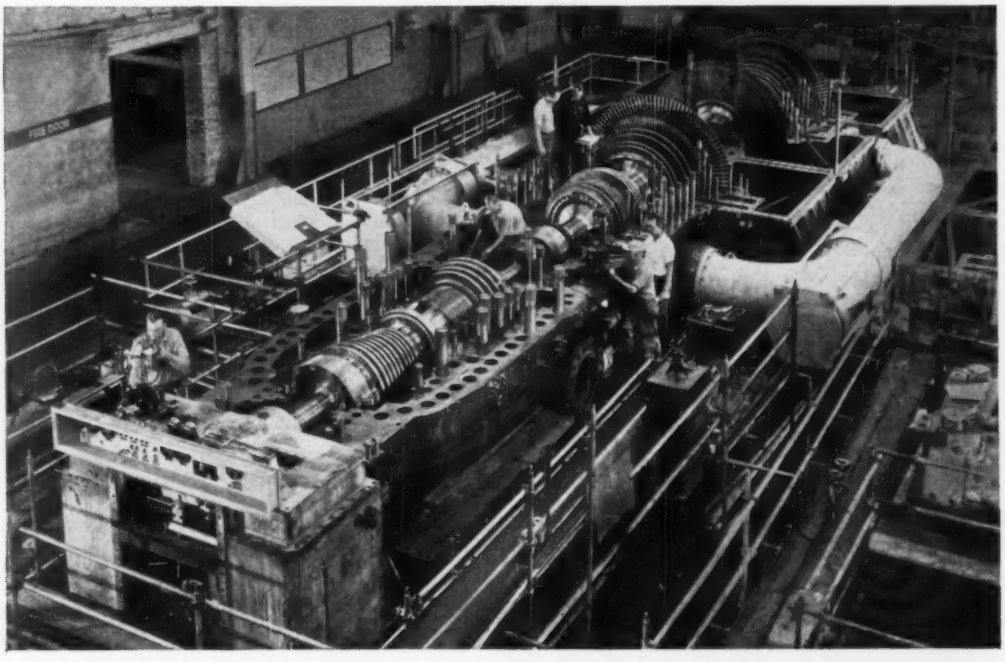
Design Firsts by Allis-Chalmers

1926	**Side-crossunders**
1934	**Separate nozzle chests**
1936	**Thrust-type hydrogen seals**
1941	**Nonsliding thrust-bearing pedestals**
1948	**Supercharged axial ventilation**

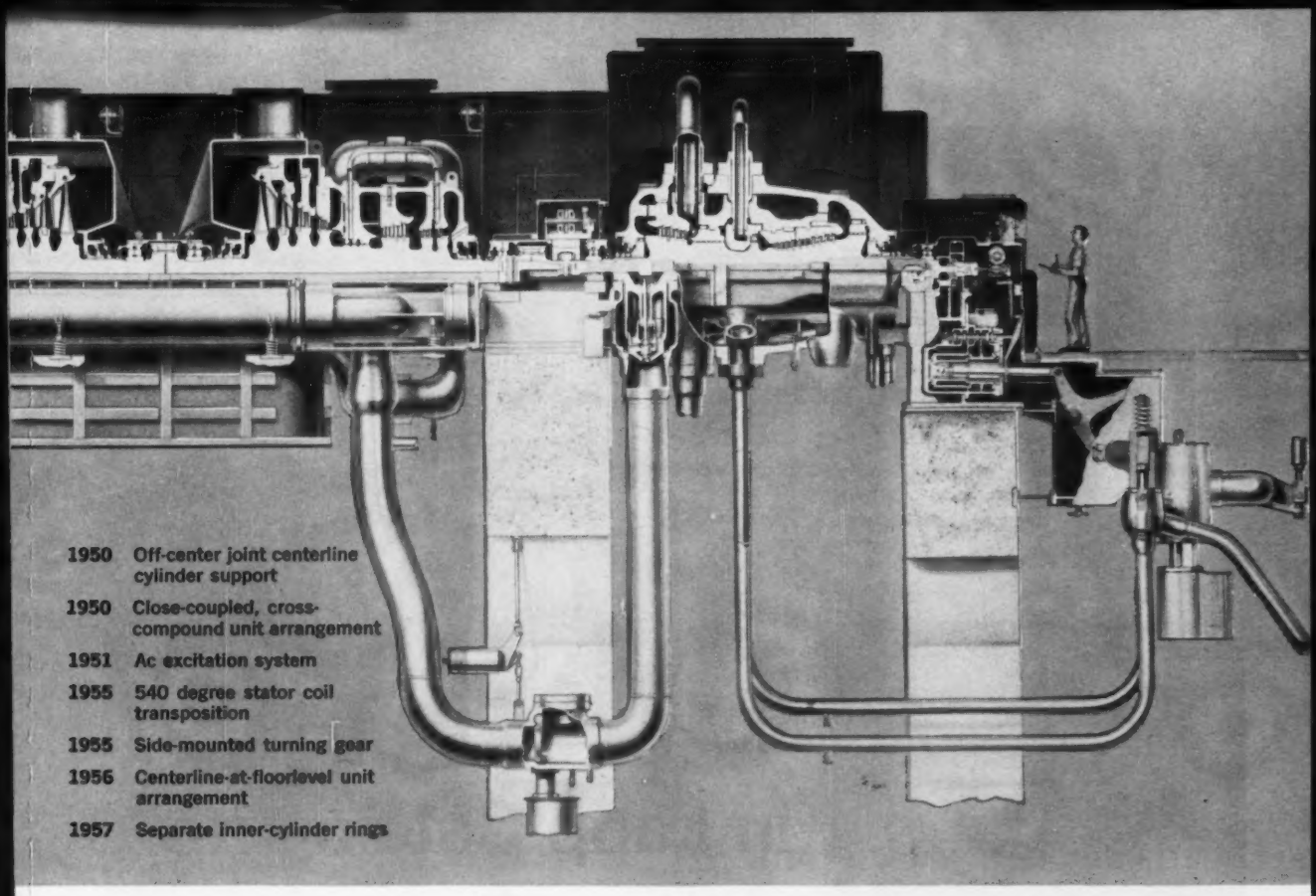
Designing today for tomorrow's power needs, Allis-Chalmers experienced, forward-thinking engineering staff has pioneered higher ratings and unique arrangements for steam turbine-generator units . . . originated and patented many of the design features now adopted as industry standards for such equipment.

PACING

NATIONAL ELECTRICAL WEEK
FEB. 7-13, 1960



Engineering know-how and the results of extensive research and development programs are confirmed on the large turbine test pits. During the past few years A-C has spent millions of dollars expanding and modernizing manufacturing facilities like these to assure that design excellence created on the drawing board is translated into the finished product.


1950 Off-center joint centerline cylinder support
1950 Close-coupled, cross-compound unit arrangement
1951 Ac excitation system
1955 540 degree stator coil transposition
1955 Side-mounted turning gear
1956 Centerline-at-floorlevel unit arrangement
1957 Separate inner-cylinder rings

POWER PROGRESS ...by design!

An Allis-Chalmers tandem triple-flow steam turbine-generator unit, for example, incorporates such industry-recognized A-C developments as . . . centerline-supported inner and outer high-temperature cylinders; thrust-balanced turbine elements with high-temperature steam confined to a single shaft of small diameter; separate below-floor front-mounted steam chest; and separate ring-type nozzle chest in a center-inlet high-pressure turbine. Also, hydrostatic thrust-bearing-type shaft seals for the fully supercharged generator.

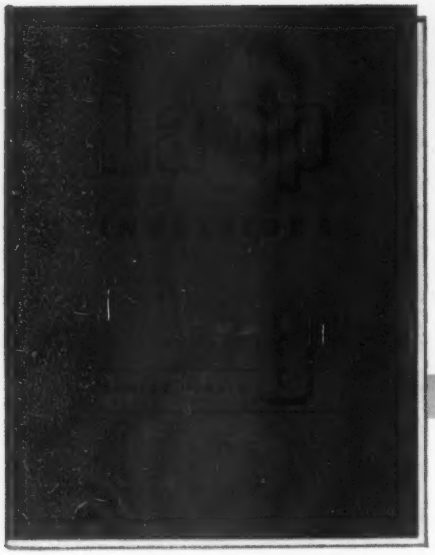
These advanced design concepts add to Allis-Chalmers growing list of firsts — set new industry standards for performance and continue the pattern by which A-C paces power progress . . . ahead of utility requirements.

NEW BULLETIN

For more information on these and other outstanding design features of Allis-Chalmers line of reheat steam turbine-generator units, contact your nearest A-C office for Bulletin 03B9448. Forty pages, illustrated by more than 100 photographs, tell how A-C is pacing power progress.

ALLIS-CHALMERS

A-1212



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MALLEABLE IRON
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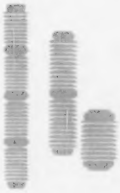
INCLUDING NEW DISTRIBUTION POSTS
HORIZONTALLY-MOUNTED POSTS
WITH INTEGRAL GAINS
CLAMP TOPS



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IN 3 STRENGTH RATINGS
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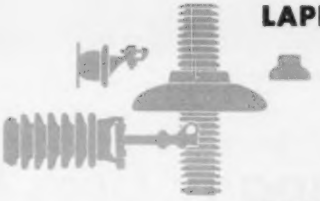

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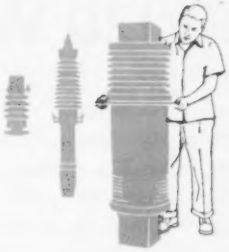

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WIDE VARIETY OF DRY-TYPE
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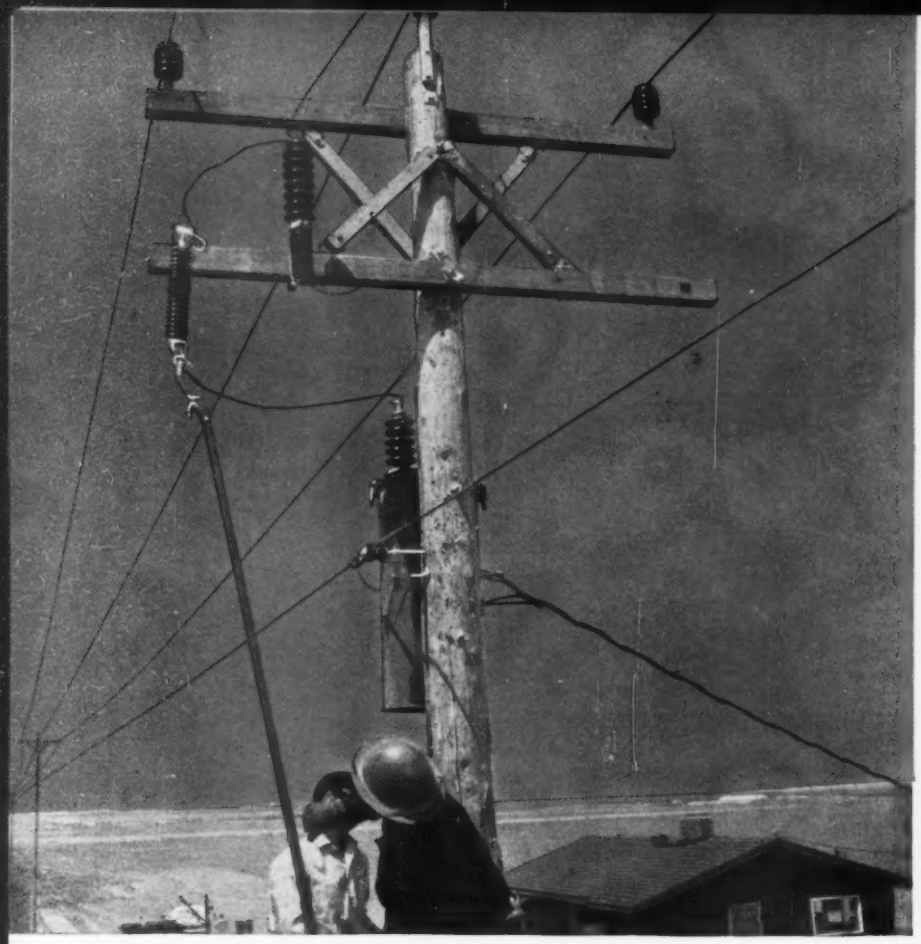
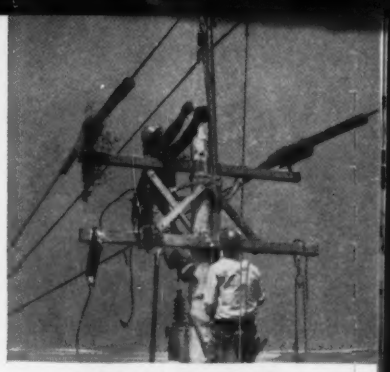
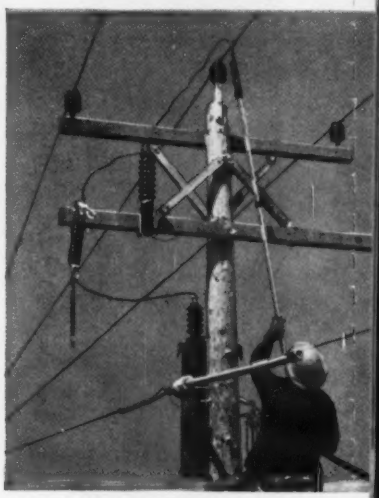


L-M 27 KV TYPE HDO fuse cutout and Type SS arrester protect this 20 kv Round-Wound transformer.



IT IS PRACTICAL to work 20/34.5 kv distribution lines hot, when proper safety procedures such as these are followed.



WITH JOB COMPLETED, hot line clamps are tightened in place prior to removal of protective line hose.

Idaho Power Company Uses L-M Equipment for 20/34.5 kv to 240/120 Volt Service Drop

Idaho Power Company has overcome the problems posed by great distances and low population density, through installation of a three-phase, four wire, 34,500 volt grounded wye distribution line. This system eliminates the need of all subtransmission and has fewer substations, less regulating equipment and higher feeder loading, resulting in lower cost per kva of installed capacity. It has proved most economical in distributing power along the 275 miles of isolated farm land.

L-M has cooperated with progressive Idaho Power through research and development of apparatus and construction materials to make this economical distribution voltage practical. All products for the 150 kv BIL system are available from L-M—switching equipment, porcelain insulators, capacitors, cutouts, lightning arresters, reclosers and Round-Wound® transformers.

Get Complete Information.

L-M offers a compilation of data on the design and operation of 20/34.5 distribution. Ask your L-M field engineer for these papers, or write Line Material Industries, Milwaukee 1, Wisconsin.

LINE MATERIAL® Industries

McGRAW-EDISON COMPANY

McGRAW EDISON

Distribution Specialists

408

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
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Editorial Comment

FEBRUARY 1, 1960

Will Wire to Build Appliance Load

Georgia Power Co's announcement last month of a plan to buy and assume responsibility for the service entrance wiring of homes and apartments wired or re-wired for major appliances or electric heating should spark a marked swing to electricity for Georgia residents. This single move checkmates the gas industry's "no costly wiring" slogan.

Georgia Power's announcement is in close harmony with the recent appeal to utility sales executives by M. R. Rodger of Middle West Service Co that they correct service entrance "bottlenecks" as the only way to combat growing gas competition and declining percent returns. Large use appliances, he observed, are usually turned off at the time of air-conditioning peaks. Consequently they help materially to offset dropping load factors for utilities which find themselves with summer load peaks. Earnings for the electric range, clothes dryer, freezer, and lighting run as high as 19% for a company whose peak is set by 10%-load-factor air conditioning. Thus these appliances earn considerably more credit as load builders on such systems than on a winter-peak system.

Four recent surveys of appliance dealers, cited by Rodger, put installation allowances in first or second place as the most desirable utility aid to appliance sales. Those putting wiring second placed advertising assistance ahead of it.

The cost of a program to correct and capitalize service entrances is well justified by the increase in revenue from new appliances it helps to put on utility lines, according to Rodger. The average cost can run as low as $1 per $1 of additional annual revenue and the return on investment 7 to 9%.

The electrical industry should enthusiastically endorse Georgia Power's decision to promote service adequacy, and welcome the company into the growing group of utilities tackling load building with realistic tools. Efforts like these will help manufacturers and utilities together to bring electrical living to their customers.

New Milestone in Right-of-Way Field

In Britain, transmission line projects associated with the English Channel submarine cable have been delayed upwards of a year because right-of-way is so difficult to obtain, and legal machinery for eminent domain proceedings is so complex. U. S. projects are facing similar roadblocks.

Meanwhile, as two Electrical World surveys and a pair of meetings emphasized, costs of R/W and the public's unwillingness to part with it are certain to become ever more difficult problems.

Therefore the Edison Electric Institute deserves special commendation for sponsoring a two-day conference of R/W representatives of member companies. Evaluating the need, EEI discovered that power company R/W men lacked a forum of their own.

A large number have indicated interest in attending this first session in Detroit, March 31-April 1. The tentative program includes panel discussions on planning, economics, and public relations, in addition to zoning, encroachments, and relocation reimbursement. The conference will be under the auspices of EEI's Legal Committee. It is not definite yet whether the conference will be an annual one.

To the participants we wish a most fruitful exchange of ideas and practices.

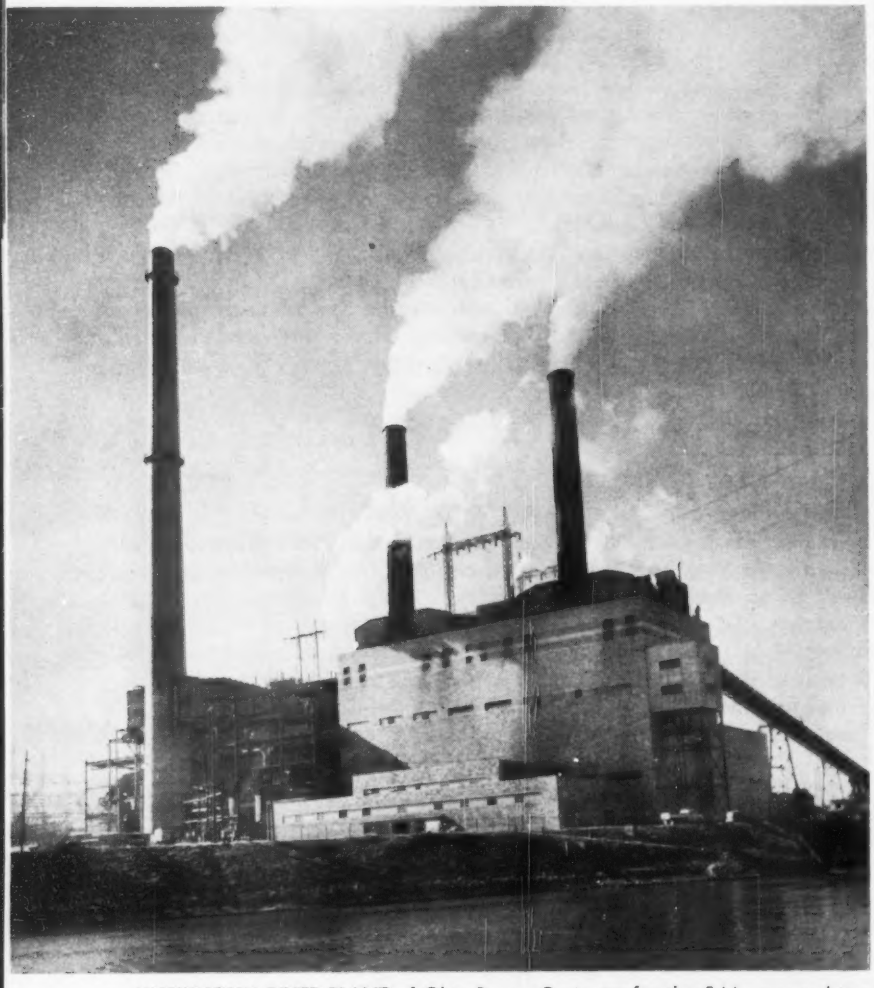
New 5-Mw Gas Turbine Will Burn

Prototype unit is joint project of American Electric Power and General Electric; it will be part of combined cycle

A 5,000-kw prototype gas turbine, burning coal gas, will be in operation early next year at Muskingum River Plant of Ohio Power Co as part of a combined cycle, with one of the plant's four existing 215,000-kw steam turbines. It will be the first time that a steam turbine and a gas turbine will be used in a combined cycle by a coal-burning plant, in the production of electric energy.

Decision to make the experimental installation was announced jointly today by Philip Sporn, president of American Electric Power Co and of Ohio Power Co, its subsidiary operating company, and by William S. Ginn, vice president and general manager of the turbine department, General Electric Co.

Objective of the combined cycle is added efficiency of generation. In later full-scale application of the cycle, an improvement of 4% in over-all efficiency is expected.



MUSKINGUM RIVER PLANT of Ohio Power Co is site for the 5-Mw gas turbine. It will be installed next to 215-Mw unit No. 1, a machine installed in 1953

At Muskingum River, the new gas turbine unit will generate an additional 5,000 kw of electric power, on its own, and it will also supply combustible by-products to the steam boiler. As a result it will reduce the amount of coal required by the boiler to generate steam for the 215,000 kw steam turbine.

Previously the use of gas turbines in power production has been limited and they have burned only natural gas, distillate, and Bunker C oils. The Ohio Power Co installation will be the first in which coal gas will be used.

The 5,000 kw prototype will operate in this manner: Coal for the gas turbine, broken down by high temperature in a carbonizer, will yield both coal gas and char. The coal gas will be burned in the gas turbine. The hot exhaust from the gas turbine will join the char in a cyclone-type burner firing into a pulverized coal-fired boiler. This cyclone-type burner is to be added to the boiler for the purpose. The char burned in this cyclone will supply part of the steam generated for the steam turbine.

Bigger Gas Turbines to Evolve

Because the installation is experimental in some respects, only a portion of the gas turbine capacity will be employed that could be used in combination with a steam turbine as large as 215,000 kw. Successful operation of the unit is expected to lead to gas turbine-steam turbine combinations in which the gas turbine capacity will be much greater. Such installations would also utilize much larger gas turbines than any designed and built to date.

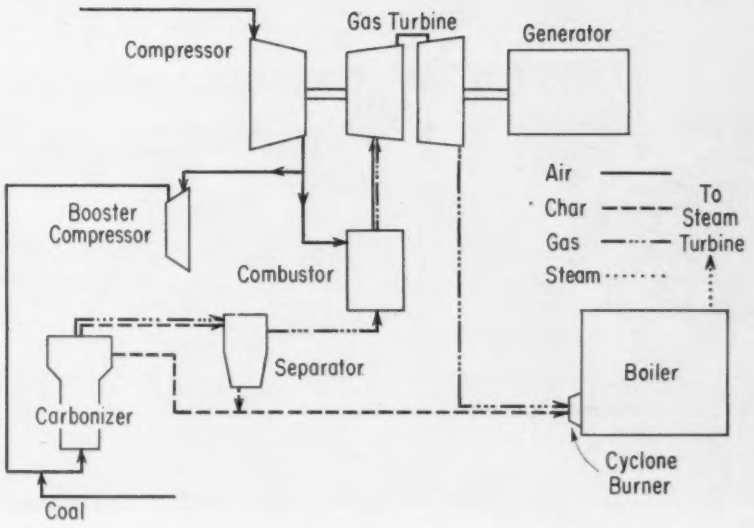
In the Muskingum River project, General Electric Co will supply the gas turbine and its control devices, the carbonizer, and related coal and char feeding devices. Design and construction of the installation will be done by American Electric Power Service Corp, an AEP subsidiary.

The gas turbine is to be housed in an annex at one end of the Muskingum River plant. It will be coupled to the plant's unit No. 1 which went into operation in 1953. This unit, plus three similar units, give the present plant a total gen-

Coal Gas

erating capacity of 880,000 kw and make it the largest power station on the seven-state American Electric Power Co system.

In their joint announcement, Sporn and Ginn stressed that this project is but another step in a long series of cooperative developments by the two organizations going back more than 40 years and having as its aim the advancement of the technology and the economics of large-scale generation of power. In this series much work has been carried out in the development of larger generating units, higher speeds, higher steam temperatures, reheat and double reheat of steam, and, recently, ultra-high steam pressures.



COMBINED CYCLE, the first of its kind, will bring 5-Mw output of new unit plus supply of combustible by-products to steam boiler, which will reduce the coal needed by the boiler to generate steam for the 215-Mw steam turbine

EEI Members Foresee Future Thermal Emphasis

Water resources report to Sen Kerr says future needs will be met primarily by steam plants; nuclear capability to hit 7,719 Mw in 1970 and 38,900 Mw in 1980 for companies

The U. S. power needs of the next 20 years will be met primarily by thermal generating plants, according to the predictions of Edison Electric Institute's members By 1970, investor-owned systems will possess a total capability of 253,139 Mw. Of this, 225,417 Mw will be thermal, 20,003 Mw hydro, and 7,719 Mw nuclear, the report states.

Ten years from now the kwhr output per capita will be 7,113 kwhr, not counting self-generation. In 1980, this will rise to 11,390 kwhr and by the turn of the century will range from 17,600 to 29,400 kwhr. Last year's output per capita was 4,010 kwhr in the U. S.

These are some of the highlights from the trade association's report submitted in mid-January to Sen Robert S. Kerr, chairman of the Select Committee on National Water Resources, which was set up by S. Res. 48.

The committee is studying the extent to which water resources in the U. S. are related to the national interest and how water resources activities may evolve in the future.

Peak loads for the nation will jump from 129,000 Mw in 1959 to 265,000 Mw in 1970 and 501,000 Mw in 1980. For the same periods energy requirements will grow from 707 billion kwhr to 1.4-trillion kwhr and 2.794-trillion. Taking this into the year 2,000, total industry generation will range from about 8 to 10-trillion kwhr, the report says.

The report says that an increased use of pumped storage hydro projects is expected. As of 1959, hydro accounted for a scant 10% of investor-owned capability and by 1980 this will drop to about 5%. In coming years, the report notes, there will be no concern about the designation of secondary, or interruptible, hydro. Most of it, with the possible exception of the Pacific Northwest, will go into primary load.

During 1959, the report says, 26,813-billion gal of cooling water was pumped through thermal plants and returned to its source. This will rise to 57,285-billion gal in 1970 and 106,409-billion gal in 1980. The designs of larger turbine generator units are permitting the rejection of fewer Btu/kwhr to cooling water. In 1940 a 5600 Btu/kwhr figure was commonplace with 35 to 40-Mw units. Recently installed units reject only 3480 Btu/kwhr, which is 63% of the 1940 average, the report observes.

As for regional gains, the investor-owned utilities in the northeast, or Region I, will experience a peak of about 48,961 Mw in 1970 and 81,821 Mw in 1980. These are the highest forecasted for any region although its rate of growth is less than the load growth in other regions. Region II peaks will total 44,357 Mw and 81,593 Mw, respectively; Region III 34,948 Mw and 73,016 Mw; Region IV, 28,406 Mw and 51,774 Mw; Region V, 37,063 Mw and 81,015 Mw; Region VI, 3,301 Mw and 6,977 Mw; Region VII, 10,800 Mw and 19,900 Mw; Region VIII, 18,707 Mw and 32,386 Mw.

Region V, the Southwestern States, probably is the fastest growing section as far as electric utilities are concerned, the report notes.

Record year hoped for as appliance manufacturers exhibit '60 wares. Three-D television and outdoor cooking spark new trends

THREE-D TELEVISION by Westinghouse captured attention of many

EXPERIMENTAL LAUNDRY-CENTER is explained by Ralph Sorenson, right, Westinghouse, to L. S. Burke, a distributor from Houston

Optimism Prevails at 1960 Appliance

DESIGNERS OF Hotpoint cook-out unit Ray Sandin, left, and Brooks Stevens get together to discuss features

As appliance manufacturers enter on a new decade in which sales are expected to reach at least 180 million units, these manufacturers exhibited some of the wares with which they hope to capture this market. The scene: Chicago's International Home Furnishings Market last month.

On hand for business on the same day that the steel strike ended, appliance executives were optimistic about the coming year for electric appliances. Said Walter Lantz, vice president of Admiral Corp, at a Monday morning press conference, "Now with the steel strike settlement, appliance manufacturers will be able to have one of their best years."

This year's show seemed to indicate that a lot of the appliance manufacturers are putting increasing emphasis on the big potential of the replacement market.

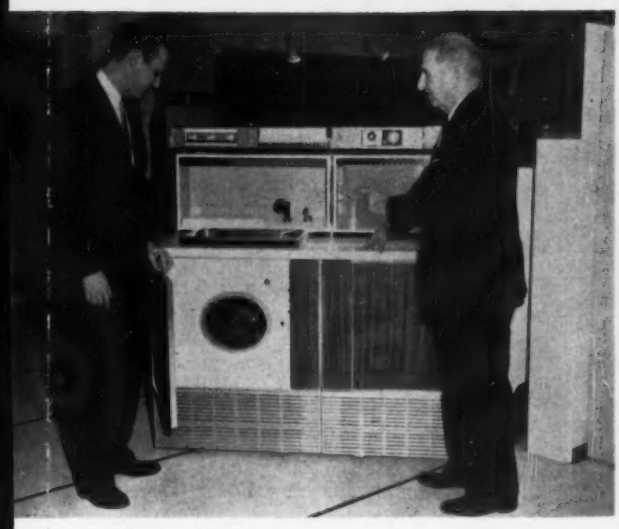
Indicative of the replacement goal was the fact innovations in refrigerators, clothes washers, and dryers, television sets, and ranges predominated markedly over the number of new appliances.

One of the hits of the show, however, in the new appliance class was Westinghouse Electric Corp's 3-D television set. Strictly an experimental model, with no predictions from Westinghouse executives as to when it might be on the market, it nevertheless drew some of the largest crowds of the show, and generated excitement whenever tested.

The set is a standard TV set but has a split screen. Two cameras are used which take two pictures of the subject. These are flashed on the screen and appear as two distinct images. Both can be seen clearly, unlike 3-D movies where, when seen without glasses, figures on the screen were blurry. With Westinghouse's set, when a person puts the glasses to his face the two images blend into one and give the 3-D effect.

Experimental models are shown at these shows to get public and industry reaction, and with an eye to future marketing.

LAUNDRY CENTER features "full-height" tumbling in this experimental model. Retractable clothes rack for drip-dry items or to de-wrinkle tailored clothes is included



ELECTRIC COOKING outdoors is expected to receive impetus with introduction of GE's "Patio Cart."

Show in Chicago

A trend toward outdoor patio cooking—electrically—was spotted. Whereas in previous years, most outdoor chefs have cooked their steaks over charcoal, now appliance manufacturers are getting into the act with barbecue grills with electric units.

General Electric Co introduced the "Patio Cart" a large, yet easily moveable, unit with a complete electric range, charcoal barbecue, and a serving center.

The built-in range includes two high-speed surface units and a thermostatically controlled aluminum griddle, all weather proofed; a deluxe oven with automatic rotisserie, removable broil unit and hinged bake unit; and remote control panel.

Hotpoint is also getting into the outdoor cooking business. Its electric cook-out unit is on wheels for easy mobility, and will still use charcoal. But, as Hotpoint officials pointed out, this is only for flavor; the electric grill units cook the steaks.

Another development from Hotpoint is its "Wonderwall" insulation which reportedly gives up to 50% more space inside a refrigerator. The secret, according to Hotpoint, is that the gas is sealed in a wrapper made of a six-layer laminated material specially designed to permanently seal in the gas. The manufacturer says the wrapper won't mat or sag, thus doubling the insulating power of ordinary insulation

Two other developments from Hotpoint—both strictly experimental— are a "Gourmet Center," and a "Custom Trend Laundry Center." The "Gourmet Center" is a combination range, refrigerator, and bar.

The "Custom Trend Laundry Center" has a newly designed dryer, with "full-height tumbling" which enables more of the surface area of clothes to be exposed to the heated air stream.

Westinghouse, in addition to 3-D TV, introduced its glide-out center drawer as the new feature in 1960 refrigerator-freezers. The drawer, which can be opened without opening any other portion of the appliance, has two compartments: one a 21-lb. capacity low temperature meat keeper, which will keep meats fresh, even though unfrozen, for as long as seven days; the other a half-bushel capacity vegetable crisper.

A Laundry Center has a 30-in. washer and a 30-in. dryer, and features a small sink for pre-conditioning clothes. Other features include: A small swing-out ironing board and built-in transistor radio.

Philco Corp introduced a convertible refrigerator. With the flick of a switch the unit turns into a freezer. The company claims its new "air wrap" will keep unwrapped meats fresh for 11 days, and vegetables for 14 days.

Frigidaire announced "stereo cooling"—room air conditioners which shoot air in four directions, thus encircling the room, or in one or two directions. The panels are divided into sections, with two horizontal louvers and two vertical.

"WONDER-WALL" INSULATION by Hotpoint is shown by Ray Sandin

Ohio Municipals Revive Grid Interest

Systems in northern Ohio study legal, engineering and economic angles; State Supreme Court ruling in Illinois provides a precedent for such interconnections there

The lure of a large chunk of Niagara project power and the diminishing reserve margins of small, aging power plants are factors behind a shift from idle speculation to serious study of tie lines between some northern Ohio municipal systems. Meanwhile, an Illinois Supreme Court decision last week stated in effect that such lines were legal and that cities had the legal right to sell electricity "within or without" their corporate limits.

The interest in Ohio centers with two groups of utilities. An eastern group made up of Cleveland Dept of Light & Power and the cities of Painesville and Orrville started thinking about interconnecting after studies by Penn-Ohio Power Development Assn last summer. The Penn-Ohio group is made up of the states' co-ops and municipals aiming for grids large enough to make imports of Niagara power economically feasible.

The three-city tie is still in the talking stage. Estimates indicate it would take about 30 miles of 33-kv or 69-kv line to connect Painesville with Cleveland and about 50 miles between Cleveland and Orrville.

Cleveland's city-owned system has a nameplate rating of 137,500 kw serving 50,000 residential and about 8,000 industrial and commercial customers. The 25,000 kw now on standby could be put to use if the intertie was made, its spokesmen say, and this would give the city time to study a link with the Niagara project. Its share of the line's cost would come from revenue bonds or cash.

Orrville, with an 11,000-kw peak load, has 16,500 kw of capacity and will add 22,000 kw more in December. The Painesville plant has a 21,500-kw steam turbine generator serving some 7,000 customers.

In the western group of cities, the reserve margins are a bit leaner, according to Norwalk's mayor Louis G. Frey. The city's formula is to keep stand-by equal to their largest unit. Idle capacity is about 6,000 kw and capacity stands at 13,000 kw, while the load is peaking at 6,700 kw.

Again, no engineering studies have been made. An estimated 50 miles of 69-kv line would be necessary for the western grid.

"All municipal systems are facing a similar problem of meeting constantly increasing power demands with a limited ability to finance more capacity," sums up Oberlin's City Manager, Richard J. Dunn.

A tie with Norwalk "is certainly possible, though I could hardly call it probable at the moment because there are many problems to be worked out first," he observes. Oberlin has 7,831 kw capacity and the load peaks at about 3,750, not counting the new Federal Aviation Agency building. "That will push our load up to about our firm capacity of 5,500 kw," says Dunn.

Both groups of systems are discussing possible central stations to serve the grids, and there are other interested communities along the prospective transmission lines.

Among the hurdles the systems face are:

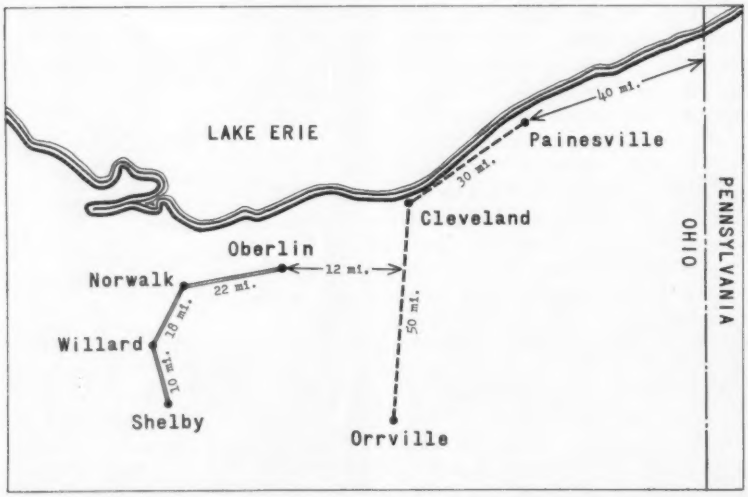
1. An Ohio law that limits diversion of more than 50% of any one city's power outside the city limits.

2. Municipalities may not enter into contracts or joint ventures with corporations, companies, co-ops or individuals. Thus the incentives for power pooling would be lessened.

3. The fiscal quandries faced by most U. S. cities in building enough new classrooms, sewers, and providing necessary services. The referendums for transmission lines probably would have rough going with today's general tax temperment.

A spokesman for Ohio Edison Co, in whose area Norwalk is located, says his company offered the city these alternatives: **1)** It offered to buy the Norwalk system. **2)** it offered to take over and service directly as its own customers a certain section of the city; **3)** it offered to take over and service directly certain customers with large power loads. Ohio Ed declined to sell Norwalk supplementary power, the spokesman says, because the company isn't interested in selling power for re-sale.

The general feeling in Illinois following the Supreme Court's Jan. 22 decision was that relations between municipal systems and inves-



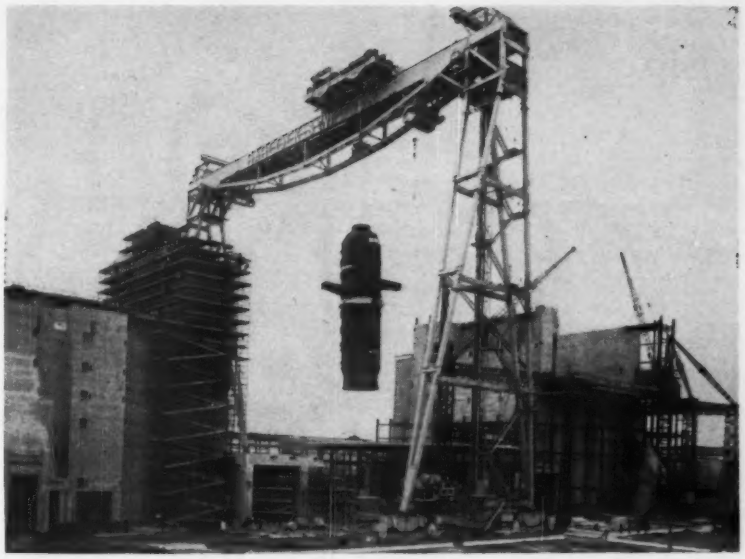
GRID DISCUSSION has progressed farthest with these two groups of municipal utilities. Observers say an intertie with co-ops to the south is also a possibility

tor-owned companies might undergo some marked change. The ruling upholds a Circuit Court decision that authorizes the construction of a $700,000, 69-kv line between Springfield and Jacksonville, a distance of 30 miles.

Illinois Power Co, which serves South Jacksonville and sections of nearby Morgan County, sought a judgment in the Circuit Court to halt the line's construction. Jacksonville was trying to infringe on its service area, the company charged.

The high court's opinion ruled Illinois Power's objection was immaterial. Cities have the right to sell electricity "within or without" their limits. However, at least 51% of their power sales must be inside the city limits. Like Ohio, municipals are limited to "a major portion" of power being used internally, but the state's statutes "do not deal in terms of surplus or excess power," the decision said.

The power company also charged that the line's construction was a step that created a new public utility, one requiring the mandate of Jacksonville voters. Not so, the court said, because the only required decision was to establish municipal ownership—a policy matter that had already been decided.



385-Ton Shell Installed at Hinkley Point

The installation of a 385-ton steel shell of a steam-raising unit was begun Jan. 12 at the Hinkley Point atomic power station. The big lift was made by the 250-ft high "Goliath" crane which straddles the reactor building. A total of 12 90-ft long and 21.5-ft dia steel shell units will ultimately be installed. Construction began on the 500-Mw project slightly more than two years ago and criticality will be achieved about the end of 1961. English Electric Co, Babcock & Wilcox Co and the Taylor Woodrow Atomic Power Group are erecting the plant.

Co-ops, Municipals Achieve Compromise on City Service

Georgia's bitter battle between electric co-ops municipal officials ended recently in a compromise that may affect similar bargaining over the whole nation, in the future.

Spokesmen from both sides of the fence say nobody lost, everybody won. But the co-ops did back down from tough terms of the co-op-sponsored bill that passed the Georgia Senate last year.

The original bill would have allowed co-ops to operate in municipalities, up to 1,000 ft from their existing lines.

The compromise bill, which unanimously passed both legislative houses in a hurry, says the co-ops can't extend their primaries in urban-annexed areas. But they can give service from existing primaries, up to 300 ft from those lines.

Also, the co-ops seem to have backed down on its tax stand. Last year, spokesmen for the co-ops were saying that each co-op would have to decide on whether it could pay the same taxes as private power. However, in a side agreement, not incorporated in the bill, the co-ops have stated that they will not ask Georgia for an extension of ad valorem tax exemption, when the present exemption period runs out next year.

Results Please Both Factions

Even though one side did apparently back down, both sides seem to be happy. Walther Harrison, manager of Georgia co-ops, and national president of NRECA, talked to an EW reporter last week, just minutes after the substitute bill passed the Georgia house by unanimous vote. Harrison said "I think this decision points the way for co-ops throughout the nation, as they face problems brought on by exploding cities and towns, they can, as we have, sit down and work out a solution that will suit both sides.

"We didn't get everything we wanted, in this compromise bill. But we got as near to a correct solution as we could have expected to get. We think this is a fair settlement. And we hope it sets an example of compromise and fairness for other co-ops that will face the same troubles in the future.

Elmer George, executive director of the Georgia Municipal Association, told EW last week, "My committee voted unanimously for this compromise. This is the best settlement we could have made for the interests of both groups."

Westinghouse to spend $3 million for 1960 . . .

Total Electric Home Program

A $3-million Total Electric Home Program for 1960 has been launched by Westinghouse Electric Corp. The company will spend this amount to increase public recognition of the Total Electric Home concept. It is 20% more than was spent for the 1959 activity, and will include a broad package of home plans custom designed for electric living.

The Total Electric Home is one in which electricity is used as the only source of energy to heat and cool the home, and for other homemaking conveniences.

Architects Designed 16 Homes

As a feature of the 1960 program, Westinghouse commissioned five leading architectural firms, located in different parts of the country, to design homes specifically for electric living. Each firm designed three homes, a small, a medium sized, and a large one. One firm designed a special house, bringing the total to 16. These homes were designed to extend over a wide range of prices and for all climates.

"These will be built as model homes, but more than that they will show people that any kind of home can be totally electric," Chris J. Witting, vice president in charge of Westinghouse's consumer products group, said. Witting is shown in photo above in front of a panel of architectural renderings for the 16 Total Electric Homes.

The cities in which they will be constructed have not been chosen. Westinghouse will work with builders and utilities in choosing the areas.

"We're convinced that the future of the Total Electric Home is assured," he noted. "The point that our 1960 program will emphasize is that it is available today, in any price range, any style, size, or section of the country."

Witting noted that America is expected to enjoy a period of high economic activity in the decade. Not enough money is going to be spent for housing unless fresh ideas are injected, however, he said. "We don't think the Total Electric Home is the only thing that will be needed to increase interest in housing, but we expect it to make a sizable contribution," he commented.

Witting and William H. Loeber, manager of the Total Electric Home department, reviewed 1959 accomplishments when more than $1 million worth of Total Electric Homes were sold. More than $7 million worth of negotiations are still underway. The program is already receiving the cooperation and active support of 85 electric utilities, they noted.

Also, Edison Electric Institute has incorporated the name for its "Total Electric Gold Medallion Home."

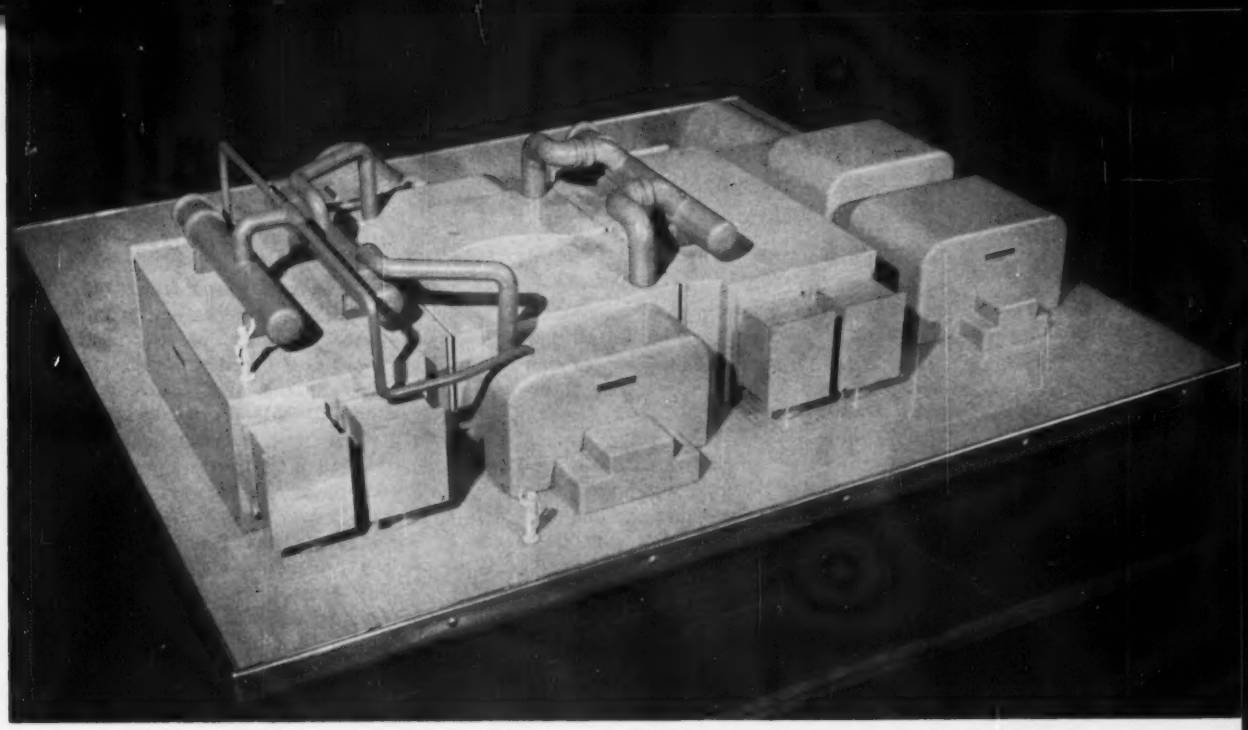
Architects participating in the 1960 program are: Robert A. Little and George F. Dalton & Associates, Cleveland; A. Quincy Jones and Frederick E. Emmons, Los Angeles; Bassetti & Morse, Seattle; Satterlee & Smith, Washington, D. C.; and George Matsumoto, Raleigh, N. C.

Ruling on Passamaquoddy Expected by September

The International Joint Commission probably will rule by September on the feasibility of the Passamaquoddy tidal power project. And IJC expects to hold public hearings for all interested parties this spring in Maine and New Brunswick.

Biggest problem facing the joint U. S.-Canadian commission is that of determining the project's economic feasibility in the face of varying interest rates in the two countries. Construction in Canada would be financed by New Brunswick provincial bonds, bearing an interest rate of 4⅛%, and in the U. S. by federal bonds at 2½%. Other issues to be settled are the long-range impact on the economies of the two areas, the possibility and type of recreational benefits created by 'Quoddy, plus other problems resulting from the unique nature of the project.

At a closed meeting in Boston, Jan. 13-15, the IJC heard the recommendations of its engineering board, which found the project feasible from an engineering standpoint. Representatives from the New Brunswick and Maine governments were present also at the meeting. IJC engineers estimate that the project would cost $687 million, generate 550,000 kw of dependable power from the tides (EW, Nov. 2, 1959, p 54).



SIDE-MOUNTED two-shell condenser with heaters on top of condenser, are features of a design that will permit installation of 325-Mw unit in the space of three former units of 1920 vintage at Commonwealth Edison's Crawford Station

Side-Mounted Condensers Save Space

Mount condensers on side of turbine and feed water heaters on top of condenser to fit new unit in old station

W. H. PLETTA, General Design Engineer, Commonwealth Edison Co, Chicago, Ill.

Visitors to Commonwealth Edison Co's Crawford Station next year may be reminded of the proverbial Hallowe'en prank when they see low-pressure feed-water heaters on top of the condenser of unit No. 8. Moreover, they'll find the condenser itself, a two-shell design, installed above the main turbine-room floor with one shell on each side of the low-pressure turbine. The condenser tubes will be horizontal and parallel with the turbine shaft.

The installation may appear unusual, but there are a number of valid reasons for the unique design.

Crawford Station was originally built in the 1920's with six units totaling 437.5 Mw. In 1958 unit No. 1 was replaced with tandem-compound 219.5 Mw unit No. 7. This year units No. 2, 3, and 4 are being removed to make room for the 325 Mw cross-compound unit No. 8 which is to be completed in time for the 1961 summer peak.

The basement and main floor elevations of the existing turbine room were maintained for the unit No. 7 design. And an economic evaluation for unit No. 8 prompted an identical decision, even though the 17 ft floor-to-floor dimension limited the design of some of the larger auxiliaries. For example, it influenced the selection and installation of a two-shell condenser on the turbine floor. The three low-pressure feed water heaters will be located on top of the condenser to conserve floor area and reduce investment costs.

Number of Valves Reduced

Actually, two new concepts will be incorporated into the design. In addition to the unique location, extraction line stop valves, and most check valves will be omitted. On most Commonwealth Edison units installed prior to unit No. 8, a stop valve was installed on the extraction line to the lowest-pressure heater, and a stop valve and check valve in the extraction line to the other low pressure heaters. All extraction line valves for unit No. 8 will be omitted except for a check valve in the steam supply to heater No. 3 which prevents excessive turbine overspeed after a tripout.

Other advantages of the design include a simplified heater drainage system, and shorter extraction lines which tend to improve the cycle efficiency by reducing the pressure drop between the turbine and the heaters.

The major disadvantage of the heater location is the fact that the extraction piping to heater No. 1 must be disconnected whenever the turbine is dismantled.

Relative positions of the 2,000 lb, 1050F/1,000F, 3,600rpm high-pressure turbine and the 1,800-rpm low-pressure turbine with the condenser shells on either side and the three low-pressure feed water heaters on top of the condenser shells, are shown in the model picture. In addition to what is shown by the model, the completed installation will have access stairways and galleries and other piping.

Gas Turbine Plant Has 100-Mw

B. C. Electric's four-unit station at Port Mann is fully automatic and controlled from Vancouver 15 miles away

Dr T. INGLEDOW, President, British Columbia Engineering Co., Ltd., Vancouver, B. C., Canada

The world's largest gas turbine generating plant is now operating on the British Columbia Electric Co system. The four-unit 100-Mw plant at Port Mann, commissioned September 25, 1959, is fully automatic and unattended, the station being controlled remotely from the head office in Vancouver 15 miles away.

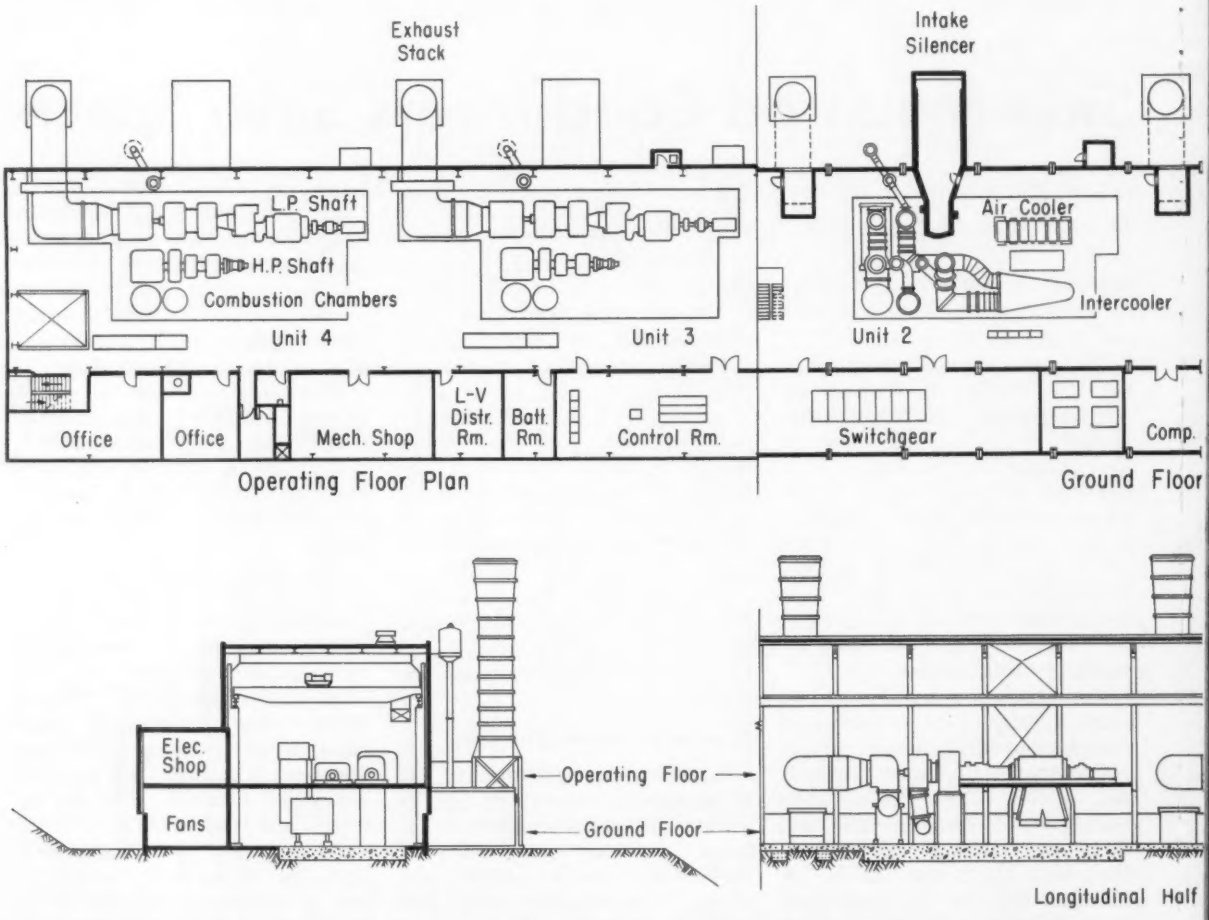
Integration of a gas turbine plant into a predominantly hydroelectric system leads to substantial economic gains to the system as a whole. Port Mann plant has three main functions:

1. To firm up capacity of the hydro system from critical to median water conditions. During low-water conditions, the plant will be operating at high load factor; at other times, it will run at reduced output or be shut down altogether.

2. To meet unforeseen peaks in event of an unexpectedly high rate of load growth, and to serve as standby in case of forced or maintenance outage.

3. To serve as emergency source of power to hospitals and other essential services in event of total system shutdown due to catastrophic outages of generating stations or transmission lines, and to provide power for starting up the steam plant under construction.

For these functions a gas turbine plant has several technical advantages over a conventional steam turbine plant. The units require only 20 min from a cold start to full load as against 4 to 6 hr for a steam plant. Because of their basic simplicity, gas turbines lend themselves to automatic and remote control. A



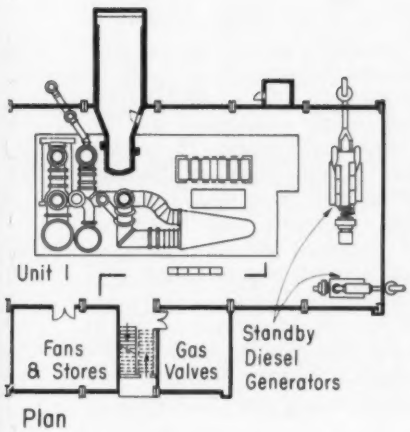
PORT MANN STATION is arranged as shown, its four units taking only 20 min from a cold start to full load and the gas turbines' simplicity disposing them readily to automatic, remote control. Auxiliaries are few at this station

Capacity

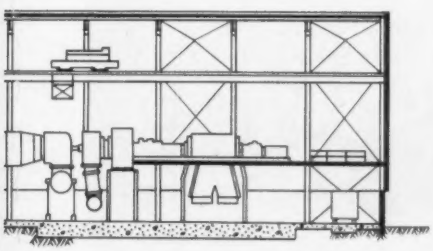
minimum of auxiliary equipment is required. They are compact and do not need heavy and elaborate foundations. Considerably less cooling water is used than with steam turbines. Construction time is shorter.

The Port Mann gas turbine plant is estimated to cost $13,600,000, or $136 per kw. About $800,000 represents the cost of the switchyard. Excluding switchyard, but including $2.5 per kw for remote and supervisory control, the 100-Mw plant cost about $12,800,000, or $128 per kw. By contrast, a recent survey in the United States indicates that steam turbine plants of 100-Mw capacity would average $145 per kw exclusive of switchyard; and automatic, unattended operation is not possible at present. Operating and maintenance costs for an attended gas turbine plant are estimated to be 80% of those for a steam plant. For an unattended gas turbine plant this figure is reduced to 50%, including fixed charges for investment in additional control equipment. Maintenance will be provided by mobile squads of servicemen.

AERIAL PHOTO shows Port Mann Station during construction. The 485 by 84-ft powerhouse has a 100,000-bbl storage tank for its alternate fuel, crude oil. Ordinarily, the plant burns some 44,000,000 cu ft of natural gas



Plan



Section

The conventional reheat steam turbine plant can be expected to give an overall thermal efficiency of about 30%; whereas, a gas turbine plant is in the region of 22%. Higher fuel cost is the main reason why gas turbine plants are not generally utilized for base load operation. But, when firming up a hydro system a more favorable picture is presented. The long-term average load factor will be quite low, 15% being typical. On this basis, gas turbines are more economical than steam turbines over a wide range of fuel costs ranging from 20¢ to 60¢ per million Btu. Higher fuel costs are more than offset by lower capital charges, operating and maintenance costs.

The primary fuel is natural gas, supplied on an interruptible contract. At full production, the station will burn 44 million cu ft daily. When the gas supply is cut off, the turbines will run on crude oil. Natural gas has a decided operating advantage compared to oil as there is virtually no fouling of the turbine blading, consequently reducing maintenance outages for washing and cleaning.

The gas is supplied directly to the turbines through a 12-in. line fed from the 24-in. line next to the east property line. Crude oil is supplied through a 12-in. line from the Transmountain pipeline 1,400 ft west of the plant site. A dyked storage area encloses a 100,000-bbl bulk storage tank and a 24,000-gal crude oil "day" tank. There is a 24,000-gal diesel oil tank for the stand-by generators.

The powerhouse is a steel framed structure of rigid bents. Considerable care was taken in its design to ensure minimum sound transmissability by means of double-skin cladding. The outer skin is asbestos cement sheets on steel girts isolated for structural vibration by rubber insulators between girt and girt clips. The lathe-and-plaster inner skin is spring suspended to isolate air vibration.

The four gas turbine units are placed longitudinally in the powerhouse to minimize width of the structure and the excavation for forming the bench on which it is

situated. Each unit is supported at the operating-floor level by an independent steel structure on independent foundation blocks. The operating floor around the unit is of reinforced concrete supported by a steel structure.

All four machines are two stage, two shaft, reheat, intercooled, open cycle units, rated 25,000 kw at 25 F air temperature, and 21,600 kw at 70 F.

Useful for Peak Loads

The greatly increased output at low ambient temperatures is useful to meet peak loads during cold snaps. To utilize the increased output, the 13.8-kv, 3600-rpm self-ventilated turbo-generators are rated 30,000 kva at 0.9 pf. The low-pressure shaft comprises a turbine, compressor, generator, exciter and starting motor. The high-pressure turbine drives only a compressor and produces no electrical energy. For both high-pressure and low-pressure shafts, the air flow in the axial compressors and the gas flow in the turbines are in the same direction, so that end thrusts tend to compensate. Rigid couplings are provided between compressors and turbines, with flexible geared couplings between other components.

Air is drawn in through sinusoidal silencers within reinforced concrete air-intake structures and enters the low-pressure compressors. After partial compression, it is recooled in the water intercooler, passes into the high-pressure compressor, and then into the high-pressure combustion chamber, where part of the total fuel charge is added. The hot gases are expanded in the high-pressure turbine and pass into the low-pressure combustion chamber where more fuel is added. From the low-pressure turbine the gases are discharged through the exhaust stack to atmosphere with about 70% of the oxygen unburnt.

Combustion chambers are arranged vertically at the side of each unit, and fuel is injected at the top. As upper portions of the chrome steel heat-resistant liners are subject to the highest temperatures, this section is formed of replaceable metal tiles to facilitate maintenance.

Each shaft has a gear-driven spring-loaded centrifugal type speed governor. The governor of the low-pressure shaft controls load on the set. Speed of the high-pressure shaft adjusts itself automatically to the load, and varies from 3600 rpm at no-load to 4500 rpm at full load. Maximum governing sensitivity is attained by a pulsator which induces pressure waves in the governing oil system. This causes the fuel regulating elements to oscillate and overcome some friction and inertia.

An automatic temperature controller enables the unit to carry maximum load at any ambient temperature without exceeding the predetermined maximum turbine inlet temperature of 1,200 F. Protection against overspeed is provided by the governors, and in event of governor failure, by emergency overspeed governors which unload the governing oil system within 1 sec.

The plant requires 24,000 gpm of water to cool the four gas turbine units. Considerable care was taken to ensure that no harm would come to the Fraser River salmon run through use of this volume. Intake and outlet structures comply with requirements of the Department of Fisheries and the International Joint Salmon Commission.

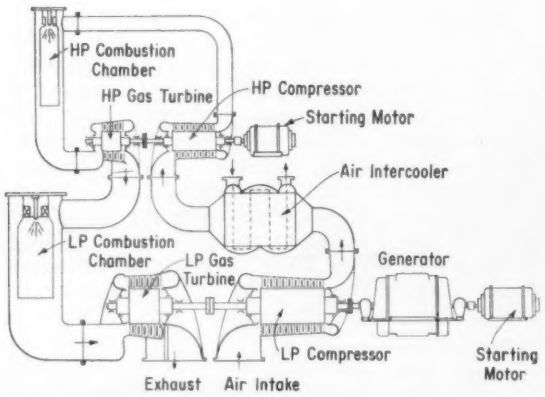
The design provides for installation of four 6,000-gpm 200-hp vertical turbine pumps. These are mounted in four reinforced concrete cells submerged in the river, to supply water to the gas turbine plant through two 42-in.-dia steel pipes against a static head of 45.5 ft. The return line operating under gravity is the same size and returns the heated water to the river through a 48-in.-dia diffusing pipe 100 ft downstream from the intakes. The main advantages of the design are:

Has These Advantages

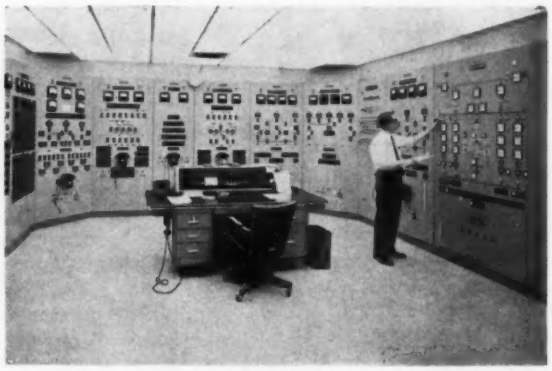
1. Precasting the lower portion of each pumpwell unit and lowering it into place on piles eliminated an expensive cofferdam and underwater work by divers.

2. Dependence upon the peaty subsoil below the riverbed to take any part of the load was eliminated by suspending the intake structure above the riverbed.

The supply and return lines between the river and plant site had to pass under some 15 railway tracks of the Canadian National Railway marshaling yard. It was essential to ensure that installation and operation of these pipelines would not endanger the operation of yard facilities. In view of the uncertain behavior of the subsoil and at the railway's request, the steel pipes were placed inside a 47-in.-ID reinforced concrete pipe, supported by



FLOW CHART of a single gas turbine unit indicates the processes started by a signal from the load dispatcher



GENERATION CONTROL PANEL for Port Mann at Vancouver initiates signals that come by carrier to the station

five pile timber bents at 8-ft centers. This design ensured a rigid structure virtually independent of future settlement of the yard area. Moreover, if the steel pipe became damaged and leaked, the water would be carried through the concrete pipe to the river.

Two 4,180,000 Btu per hr hot-water boilers, operating at 60 psig and 200F, supply heat for turbine fuel oil preheat and maintaining building temperatures. Combustion equipment provides for automatic operation on crude oil or natural gas.

Provisions have been made for installation of a third boiler, which will be required if bunker type heavy oil is used as turbine fuel. The boiler operating pressures would then be raised to 150 psig and the operating temperature to 365F for adequate heating of the heavy turbine fuel oil.

Heating Described

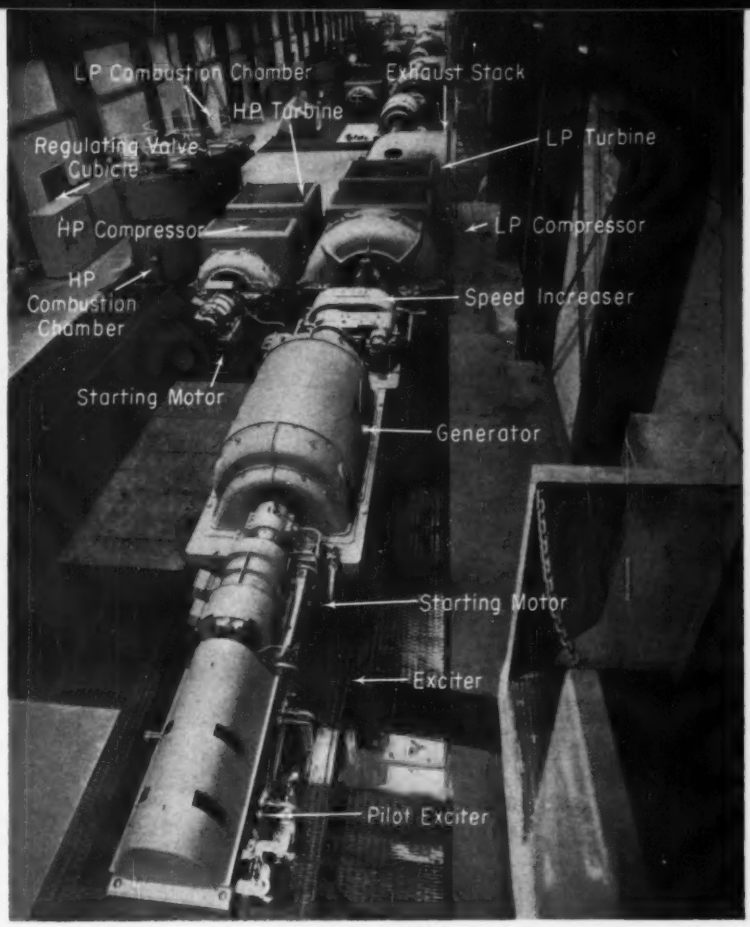
The turbogenerator building is heated by suspended unit heaters and maintained at a design winter temperature of 55F minimum, as required for cold startup of main turbine. The complete building heating and ventilating system is designed to maintain conditions for unattended plant operation.

The turbines will liberate heat which will, at times, exceed building heat requirements. Cooling is then effected by a modulated supply of filtered outside air with a total capacity of 164,000 cfm.

The turbogenerator building annex, housing controls and auxiliary equipment is heated by air ducted from ventilation units to maintain 55F minimum temperature. This section is supplied with 20,000 cfm of electrostatically filtered ventilation air. The air supply is discharged through weighted backdraft dampers to the turbogenerator area, the dampers maintaining constant positive pressure within the annex.

Each generator connects through underground cables to a 1500-Mva air blast circuit breaker in the switchyard. Power is fed from a single 13.8-kv bus to the adjacent 230-kv Horne Payne-Ingledow transmission line through two 50-Mw 3-phase FOT step-up transformers and 1,200-amp, 6,000-Mva-capacity air blast circuit breakers.

Station services are supplied by a 5,000-kva 13,800/2,300-v transformer with two diesel generating sets as standby. The diesel sets, rated 350 and 1,500 kw, enable the plant to be started during a system shutdown. To maintain lighting and station services in a plant shutdown power can be fed to the 460-v bus from a nearby 6,900-v distribution line.



COMPONENTS of LP unit are lined up from the pilot exciter (foreground) to the exhaust stack which leaves the building. Elements to left are HP parts

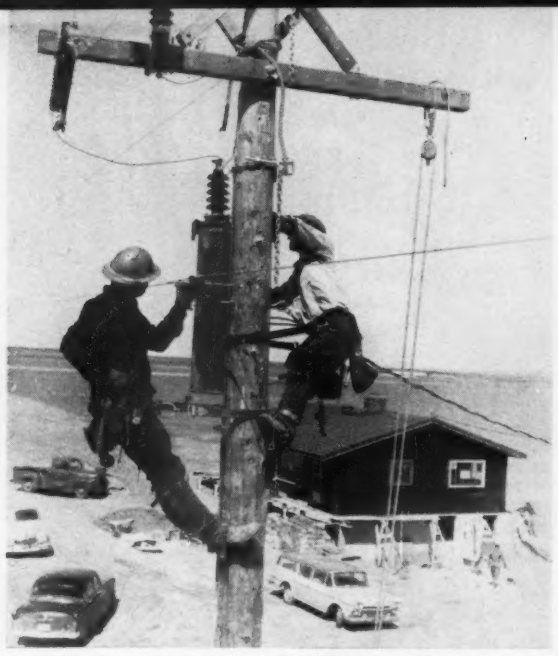
Signals from the Vancouver head office are transmitted by microwave radio to Ingledow Substation, a distance of 3 miles. Here, signals are converted and continue by a single side band power line carrier to the Port Mann plant.

To start a unit by remote control, the turbine switch is simply turned to the "run" position. When this command is received by supervisory equipment at Port Mann, it sends a signal back to the supervisory in the head office. This causes a light to flash, indicating that the information has been received.

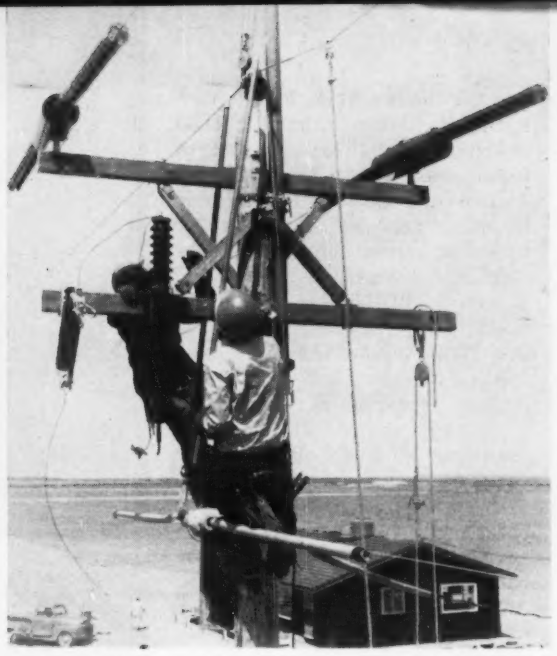
The impulse received at the station initiates in the right sequence all operations for starting the unit. Fuel and cooling water valves are opened, auxiliary motors started, and starting motors for the low-pressure and high-pressure shafts bring their stages to firing speed (approximately 30% synchronous speed) within about 4 min. Once the combustion chambers are fired, the gas turbine develops power and accelerates the set. Above firing speed, power to the starting motors is cut off, although the starting motors continue to turn with their brushes lifted. When operating speed is reached, the unit is automatically synchronized to the system and the speed governor takes over. After execution of the command, another signal is sent back to the head office, and the light on the Mimic diagram stops flashing, indicating that the required action has been completed.

Once the unit is on the line, load or voltage can be increased or decreased by pressing the appropriate

(*Continued on page* 75)



LINEMEN complete single-phase transformer installation to serve new farm home on 20/34.5-kv distribution line



MIDDLE PHASE of 20/34.5-kv line is lowered to insulator after installation and while primary is energized

20/34.5-Kv Distribution Favored

Idaho Power crews like spacing and clearances, ease in locating trouble on system that has grown to 300 miles

D. L. ANDREWS, Distribution Studies Engineer, Idaho Power Co, Boise, Idaho

Operating experience with 20/34.5-kv distribution on the Idaho Power Co system over 11 years has convinced linemen and servicemen that there is very little difference from operation of 7.2/12.5-kv lines. They state that 20/34.5-kv primary is usually easier to maintain. The greater spacing and clearance affords more room for using hot-line tools that are necessary at voltages greater than 5 kv. Line covers are available from at least three manufacturers for protecting a man who must work close to a live conductor.

Usually trouble is easy to locate at the higher voltage as cracked insulators or broken wires make the trouble easily visible on the first patrol.

Idaho Power first used ten miles of 34.5-kv distribution line in 1948 to provide power to five pumps in the desert country north of Rupert, Idaho. The system has grown steadily to 300 miles, supplying nearly 45,000 hp of irrigation pumping load and 250 residential and farm customers. Nine wye-connected radial feeders are fed from three 138 to 34.5-kv bus-regulated substations totaling 50,000 kva. Interconnection between feeders and substations is practicable through manually operated pole-top switches.

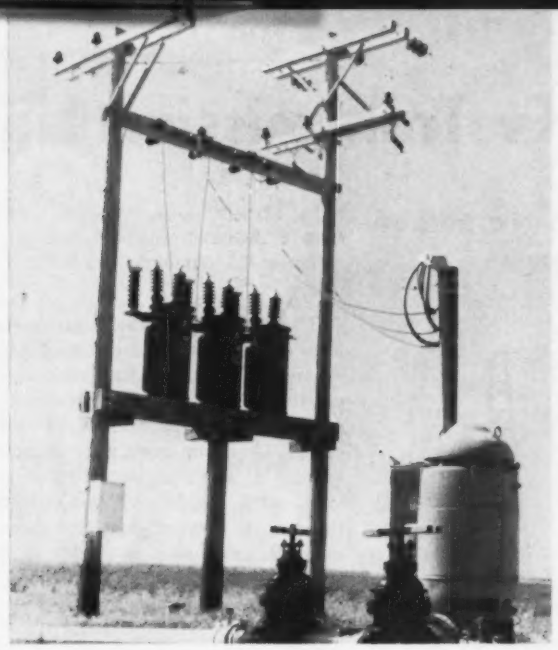
Gives Good Regulation

One of the new system's virtues is its ability to supply good voltage regulation. The longest branch of any feeder is about 20 miles, corresponding to only 7 miles for a 12.5-kv feeder. With the lighter relative load, a nearly flat voltage regulation characteristic is realized along the feeders even where minimum-size conductor is used.

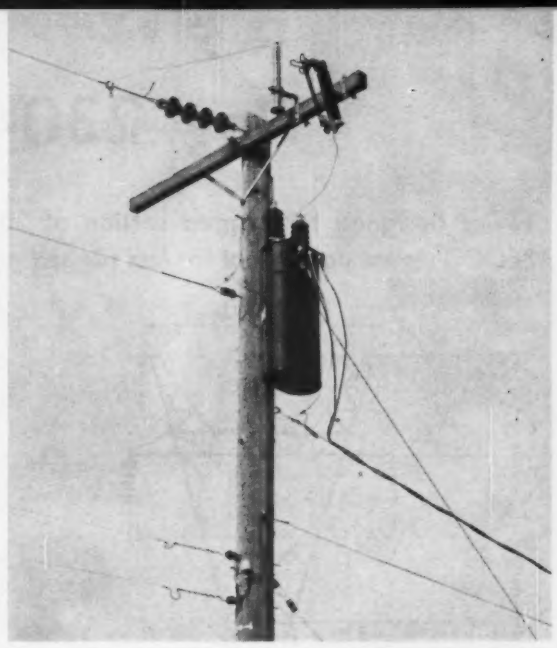
Servicemen report that no complaint of low voltage has ever been substantiated on 20/34.5-kv primary feeders. It is believed that other considerations will limit the length of these feeders before it becomes necessary to install line regulators in addition to the substation bus regulation. Motors up to 400 hp supplying irrigation pumps are regularly line-started without objectionable effect on the voltage supplied to other customers. During the light-load season an entire substation may be taken out of service without low voltage being experienced by the customers thus served. This is done simply by carrying the load over tie switches to feeders from adjacent substations.

As distribution substations for the 20/34.5-kv system average four times the size of those for 7.2/12.5 kv serving a similar area at a given total load, there are fewer 34.5-kv substations to be maintained. It is company practice to overhaul each feeder oil circuit breaker yearly. There are only a third as many switches to be maintained on the 34.5-kv system as the feeders are supplying three times the power supplied over a 12.5-kv feeder. Substation operation and maintenance are much less expensive.

Automatic tripping and reclosing are accomplished by the feeder oil circuit breakers controlled from induction-type over-current relays in both the phase and neutral conductors with instantaneous elements as an integral part of the phase relays. Tripping can be instantaneous



IRRIGATION PUMP INSTALLATION (typical 200 hp) is supplied by three 75-kva, 23.5-kv to 480-v transformers



JOINT-USE CONSTRUCTION with telephone company has single-phase 20-kv residential transformer installed

by Linemen for Workability

at any time after a 6-cycle transient delay. Reclosure is one instantaneous, plus one reclosure after 20 sec delay, plus one reclosure after 50 or 60 sec delay.

Performance of the system compares favorably with other distribution systems in trips per year per mile of line. As much longer feeders are practical and coordinated fusing or sectionalizing has not been employed, one relatively minor fault may take a large area out of service. It is hoped that the company will be able to install reclosers at midpoints of some longer feeders to minimize the area affected by one case of trouble. With the high saturation of 3-phase load, single-phase sectionalizing devices are not used except on single-phase taplines.

System Good Neighbor

The 20/34.5-kv distribution system is a good neighbor. In avoiding radio and TV interference, precautions beyond standard distribution construction practice, with proper attention paid to hardware spacing and spring washers, need not be taken. There are no local TV stations and only two local radio stations, and reception is satisfactory.

Small amounts of power are readily supplied by this distribution system for new homes or small industry. Extension of the primary neutral to nearly all branches of the feeders makes single-phase transformer installations, however small, entirely practicable. Supplying small loads is accomplished easily.

Telephone circuits—mostly open wire—make joint use of poles in the system, and operation has been satisfactory. A second telephone company has expressed willingness to make joint-use installations.

Construction specifications for the 20/34.5-kv system have been written to make conversion of present 7.2/12.5-kv distribution lines easier as load increases indicate the change is required. The capability of a feeder can be increased between 2.76 and 7.62 times without a change of conductor or installation of additional circuits. This compares favorably with the more common conversion from 2.4/4.2 to 7.2/12.5-kv with its gain of between 3 and 9 times in load carrying capability. Present construction specifications for 7.2/12.5-kv lines are being revised, eventual conversion to 20/34.5 kv being the aim.

The 200-BIL equipment available as standard for transmission is often too expensive for distribution. But some manufacturers have developed a complete line of 150-BIL equipment for 20/34.5-kv distribution. An important item is the 20-kv distribution transformer with lightning arrester and fused line disconnect. Cluster mounting of transformers works out well up to the 50-kva size and may be extended to 100 kva.

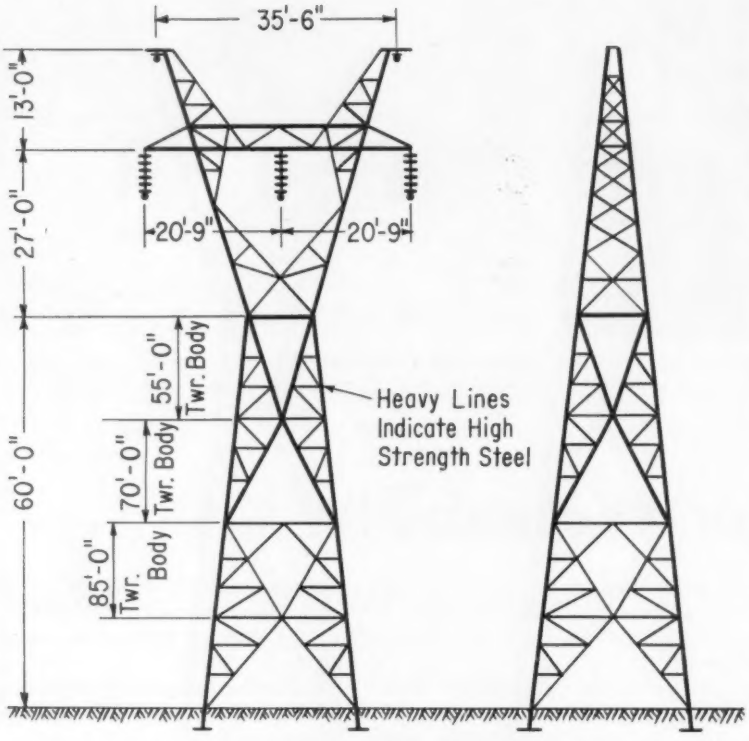
Capacitor installations on 20/34.5-kv lines have been accomplished by series connection of three 7,200-v units between phase and neutral. The cases of two capacitors are insulated above ground using apparatus insulators. A typical capacitor installation consists of 900 kva with fused load-break switches for connecting to the primary. Unipart insulators are now available at attractive costs.

The use of regular distribution crossarms and deadends makes line costs per mile only slightly higher than for 7.2/12.5-kv primary. IPC construction specifications for 20/35.5-kv lines call for 8-ft cross-arms, a pole-top pin to carry the middle phase, and a neutral 5 ft down on the pole in a 4-wire configuration. Four 6-in. disk insulators are used for dead-ending conductors from No. 4 to No. 4/0 ACSR.

New 230-Kv Transmission Line

Tower designed for rugged section of 20.6-mile tie from SEGCO steam station, not for less rugged passages

W. A. BOONE, Senior Engineer,
FRED E. ROGERS, Engineer, Alabama Power Co, Birmingham, Ala.



Air Gap Clearance – Conductor to Steel

Insulator Swing	Clearance
0 deg.	7 ft. - 6 in.
20 deg.	6 ft. - 4 in.
30 deg.	5 ft. - 3 in.
45 deg.	3 ft. - 6 in.

FIG 1—TYPE A TANGENT SUSPENSION TOWER for new 230-kv line is a lightweight unit which can be erected at a cost not higher than that of any other type

Three new 230-kv transmission lines to load centers are required by Alabama Power Co to enable it to get its fair share of the production of the new Southern Electric Generating Co steam plant near Wilsonville, Ala. The first line, 20.6 miles long, tying the SEGCO plant with the Leeds Transmission Substation near Birmingham, is under construction and expected to be completed in early 1960. Initially it will bring power into the construction area for building and starting up the SEGCO plant.

Two Concepts Considered

As the line traverses two different terrains in about equal proportions, two design concepts had to be considered. The northern half or Leeds end passes through the rugged Southern Appalachian Mountains, where steel or concrete structures must be used. There the average span will be 1,510 ft, and the greatest span 3,135 ft. A quarter of the total spans will exceed 2,000 ft. The southern half of the line will pass through rolling, wooded areas, where wood structures will be suitable and economic.

The basic design features for wood and steel construction and the conductor size were established by load studies. As the line is in a medium-loading area, an 8-lb wind plus ¼-in. ice cable loading was used in determining cable tensions and structure loads. Conductor sag and tension curves were developed from the manufacturers' by applying these limiting conditions:

Tensions Applied

- Maximum tension with design loading at 15F not to exceed 50% of ultimate cable tension.
- Maximum tension under initial conditions with no wind or ice loading at 15F not to exceed 33⅓% of ultimate cable tension.
- Maximum tension under final

Table I—General Data on Wilsonville-Leeds 230-Kv Line

Total line length,—Miles	20.6
Conductor size	1,033.5 MCM 45/7 ACSR
Shield wire size	⅜ in. 7-Strand H.S. Steel
Insulators—Suspension and Angle	Susp.—16 Units per String
B.&S., 5¾ in. x 10 in., M.&E. Strength 15,000 lb	Angle—18 Units per String
Insulators deadend Strings	18 Units per String
Clevis, 5¾ in. x 10 in., M.&E. Strength 25,000 lb	
Towers per mile	4.08
Steel per mile,—tons	
(a) Including three terminal double circuit deadend Towers	24.9
(b) Less than three deadend towers	20.5
Average span,—ft	1,305
Maximum span,—ft	3,135

Adapted from a paper presented at the Engineering and Operating Section, Southeastern Electric Exchange Conference, Atlanta, Ga., October 15-16, 1959.

Features Light Steel Towers

conditions with no wind or ice loading at 15F not to exceed 25% of ultimate tension.

It was found later that the limiting factor for sag and tension calculations with the ruling spans on this line was 25% of the ultimate cable tension under final conditions.

Compared for Cost

Selection of the structure type was considerably more involved. General types investigated were: Concrete H-frame; steel H-frame guyed; and steel H-frame self-supported; X-braced wood H-frame; and a waist-type, light-weight steel tower. Comparison of the initial costs of a line using these different structure types was made by spotting structures on about 10 miles of the line and obtaining an average cost per mile for each. Costs for wood construction were obtained from the actual costs of a 150-mile, 230-kv line built in 1953, adjusted to present levels. Steel and concrete construction costs were obtained from manufacturers' cost data, cost experience published by other utilities, and labor estimates of experienced construction department personnel.

Concrete Too Costly

The estimates eliminated concrete structures as too costly and heavy, and showed that light-weight steel towers would cost about 18% more than wood structures. But the annual cost study, comparing wood and light-weight steel construction —using estimated average cost per mile, average expected life, annual maintenance costs, increased replacement costs, etc—showed that wood construction was only slightly cheaper.

While pure economics favored wood structures, other factors led to the selection of the waist-type, four-leg, light-weight steel tower. The factors were: Reliability, as this is an important line in the Alabama Power system; higher strength for long spans; lower maintenance requirements; and the eased access problems through the use of light-weight pieces of steel. Construction-cost estimates of the several types of light-weight steel structures showed that the type selected could be erected at a cost not higher than that of any other type.

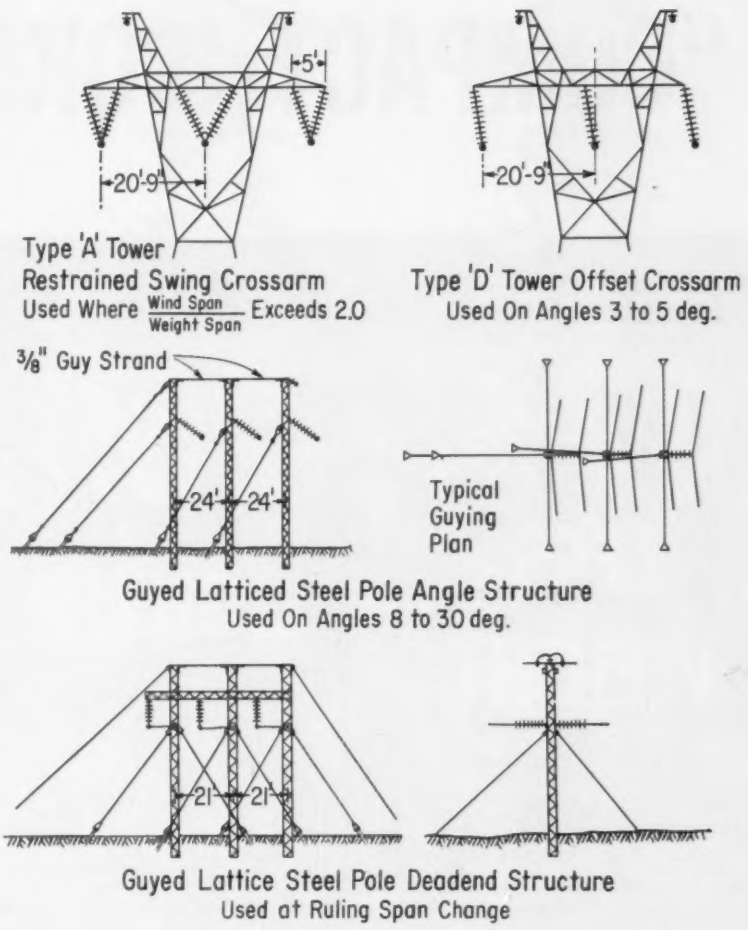


FIG 2—OTHER TOWER TYPES have the configurations and dimensions shown above. Type D tower is a slightly heavier version of Type A for special situations

The towers used were developed with tower loads, overload factors, and dimensions furnished by Alabama Power, such data being based on experience with lines in similar areas.

The Type A tangent suspension tower is a very efficient design of a light-weight, single-circuit tower. High-strength steel is used in all the main stress members to achieve a light tower. (The 100-ft Type A tower with grillage footings weighs less than 10,000 lb.) It is set up with 5-ft panel points along the leg members. The configuration is such that the overall height can be varied in 5-ft increments from 60 to 100 ft. Side hill extensions in 5-ft increments are easily obtained by using the leg extensions set up for the various height towers. A 5-ft side hill extension for a 65-ft tower can be obtained by using a leg extension for a 70-ft tower.

The Type A tower was proved by full-scale tests on a 100-ft tower at the manufacturer's plant. The only original design changes required were in the spacing of the lower tower section redundants from 7½ to 5 ft and strengthening of cross-

(*Continued on page* 46)

General Electric Announces NEW

"COMPACT ISOKRAFT* 50"

17% LESS WEIGHT than the former "ISOKRAFT 50" Capacitor

26% LIGHTER than the next lightest 50 Kvar Capacitor

20% LESS VOLUME than the next smallest 50 Kvar Capacitor

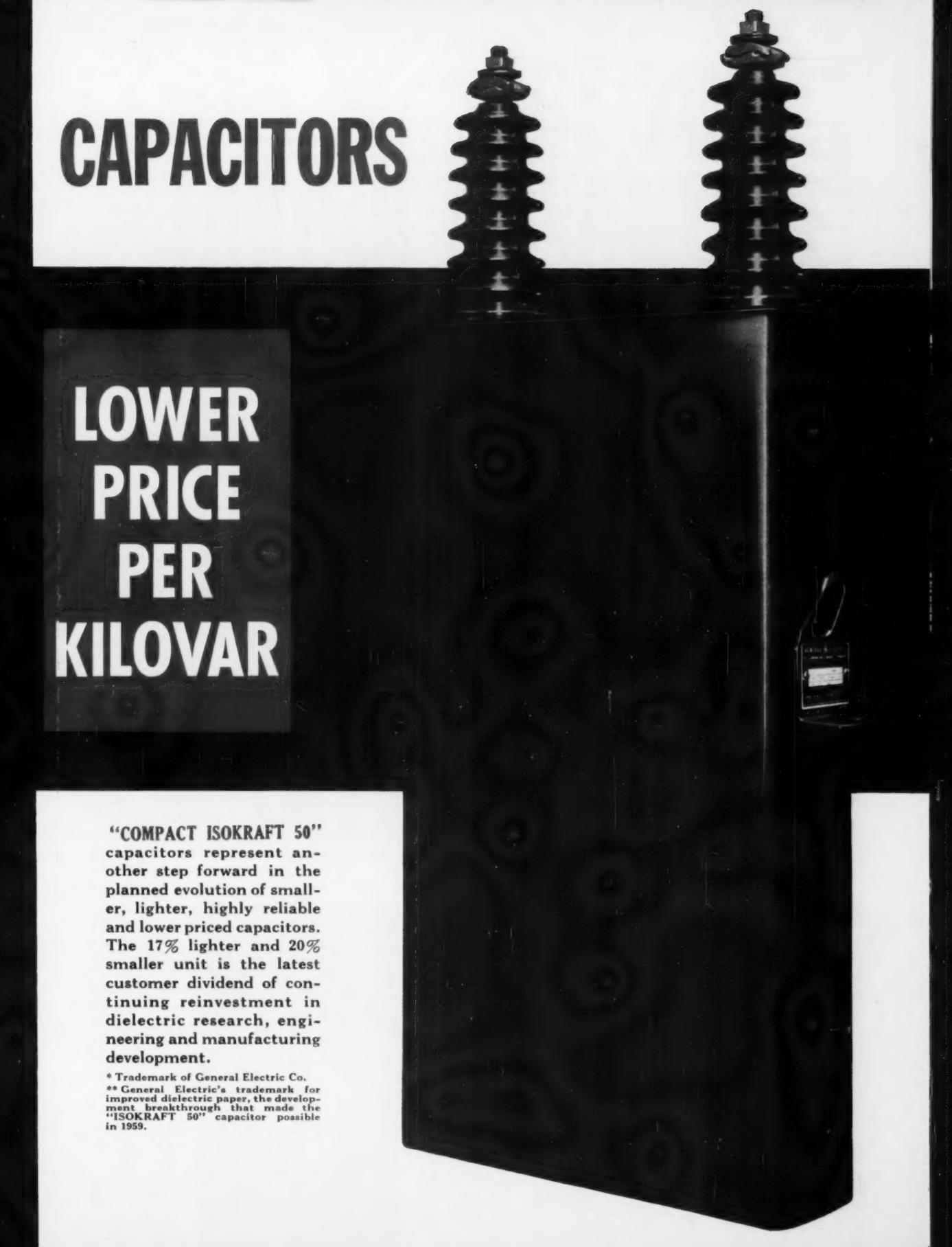
NOW WEIGHING ONLY 82 POUNDS, General Electric's new "COMPACT ISOKRAFT 50" capacitor is by far the lightest, smallest, and easiest to handle 50-kilovar unit ever available. Improvements in ISOKRAFT** paper dielectric, refinements in quality control and better manufacturing techniques make possible this compact unit and contribute to its lower price. "COMPACT ISOKRAFT 50" units cost less to install than other heavier, bulkier capacitors. The reduction in weight from the "ISOKRAFT 50" capacitor's 99 pounds permits even more kilovars per pole. For example, now G.E.'s new 900-kilovar switched equipment weighs the same as the original 600-kvar equipments. For future planning these lighter capacitor units and equipments will permit use of smaller poles.

Contact your General Electric Sales Representative for complete information on the new "COMPACT ISOKRAFT 50" capacitor, or write for Bulletin GEA-7061, Section 445-30, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

CAPACITORS



LOWER PRICE PER KILOVAR

"COMPACT ISOKRAFT 50" capacitors represent another step forward in the planned evolution of smaller, lighter, highly reliable and lower priced capacitors. The 17% lighter and 20% smaller unit is the latest customer dividend of continuing reinvestment in dielectric research, engineering and manufacturing development.

* Trademark of General Electric Co.

** General Electric's trademark for improved dielectric paper, the development breakthrough that made the "ISOKRAFT 50" capacitor possible in 1959.

230-Kv Line Has Light Towers (*Continued from page 45*)

arm members. But the lighter crossarm with an additional redundant member on all Type A towers is used in this line. In the event of a broken conductor at the end of the arm, the crossarm should fail before the main tower body members become overstressed. It is much easier to replace a short section of crossarm than a lower leg member.

Span Is 1,650 ft

The design transverse-wind span for the Type A tower was selected after spotting towers on the entire line. The span selected was 1,650 ft, although about 10% of the tangent towers (excluding crossing towers) had wind spans in excess of this figure. The original plan was to include these towers with several small angle towers as a Type B tower with loading exceeding that of the Type A tower. When the re-design of the Type A tower lower section proved it good for a 1,900-ft wind span, the Type B tower was eliminated. In selecting the design weight span, line spotting was used as a guide with the span purposely set high. Vertical loads add little weight.

Ultimate tower loads, checked against the National Electric Safety Code, were found to equal or exceed Grade "B" loading in a medium-loading area. Although not required by the NESC for Grade "B" construction, it was felt that the Type A tower would be strong enough to withstand one broken conductor or shield wire. The design load was taken as 80% of the maximum tension in the cable with ice and wind loads, and is an arbitrary figure. Experience shows that broken conductors of the size used are rare, but a number of conditions, such as differences in ice and wind loads in adjacent spans, ruling span variations, and wire stringing operations, impose longitudinal load on a tower. The broken wire assumption is a convenience for providing tower strength to cover all these conditions.

Longitudinal Loads Cut

In establishing design longitudinal loading an attempt was made to arrive at a reasonable figure that would give a balanced design with the transverse design loads. The tower design should not be penalized by setting a high longitudinal loading materially increasing weight. Moreover, a reasonable design figure for one broken cable, which would insure that the crossarm, and particularly the tower members above the waist not effected by transverse loads, would be stressed more in proportion to the transverse members, was desired. The transverse and longitudinal design loads are evidently well balanced in this tower design, as the manufacturer could give only a small reduction in tower weight by reducing the longitudinal loads.

Six Types in Use

In addition to the Type A tangent suspension tower, six other types will be in the line. These, along with the quantities used, are:

Type A—Tangent suspension	62
Type C—Extra-long weight span, double suspension	3
Type D—Crossing, long-span tangent, small angle suspension	11
Type E—Semi-deadend strain	1
Type F—Double circuit deadend	3
Guyed latticed steel pole angle structure	3
Guyed latticed steel pole deadend structure	1
Total towers	84

The Type C tower will be used on the three highest ridges. It is designed for a very long weight span (4,300 ft). Each conductor is supported by double suspension insulator strings 5 ft apart to avoid a vertical deflection angle in excess of 30 deg on the suspension clamps. The strings also support the heavy vertical load. This type tower is designed for a combination of vertical, transverse, and longitudinal loads of one broken cable with an overload factor of 2.0.

The Type D tower is a slightly heavier version of Type A. It will be used on extra long tangent spans, at small-angle locations, and at railroad and major highway crossings. For small line angle locations it has an offset crossarm to avoid reducing the gap clearance when the insulator string swings over due to the resultant angle force on the conductor. Because this tower will be at important locations, it was designed for any two conductors broken.

(*Continued on page 50*)

Table II—Type "A" Tower Design Data

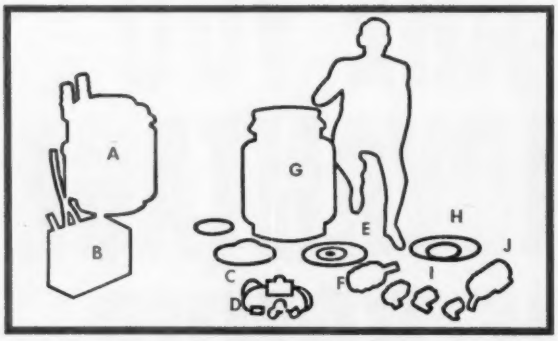
Condition	Design Loading	Overload Factor	Ultimate Loading
All Wires Intact. 12 lb. Wind—0 in. Ice or 8 lb Wind	1. Vertical on wires	1.5	3,510 lb.
	(a) 2 S.W. @ 1,170 lb = 2,340 lb		
	(b) 3 Cond. @ 4,225 lb = 12,675 lb		19,012
			22,522 lb Total
¼ in. Ice to Give Maximum Loading	2. Transverse on wires	1.5	
	(a) 2 S.W. @ 1,110 lb = 2,220 lb		3,330 lb
	(b) 3 Cond. @ 2,300 lb = 6,900 lb		10,350
			13,680 lb Total
	3. Wind on tower of 20 lb/Ft.² on 1½ × projected area of one face	1.5	
	4. Dead load weight of tower	1.5	
Longitudinal One Wire Broken	1. Any one wire broken	1.1	
	(a) 5,400 lb @ S.W.		5,940 lb
	or		
	(b) 11,600 lb @ Cond.		12,760 lb
Heavy	1. Vertical acting singly at one support	1.5	
	(a) 3,000 lb @ S.W.		4,500 lb
	or		
	(b) 8,000 lb @ Cond.		12,000 lb

Allowable Spans Medium Loading Area

Weight span 2,500 ft, Wind span 1,900 ft: 3—1,033,500 cm 45/7 Strand ACSR Cond.; 2—⅜ in. High Strength Steel S.W.

ARE YOU TAKING ADVANTAGE OF THE BONUS FEATURES ON GENERAL ELECTRIC DISTRIBUTION TRANSFORMERS?

GENERAL ELECTRIC



(A) NEW G-E DISTRIBUTION TRANSFORMER; (B) Permalex* insulated coils; **(C)** Melalast* finish cover; **(D)** breaker with new settings; **(E)** Nitrile rubber gaskets and overload light; **(F)** new high-voltage bushing; **(G)** steel tank; **(H)** stainless steel clamps; **(I)** Strenicor terminal clamps; **(J)** Thyrite* Magne-valve arrester.

On General Electric Distribution Transformers, in Addition to 20% Extra Loadability . . .

Bonus Features Reduce Operation and Maintenance Costs

Get higher loadability with new Permalex insulation– plus outstanding bonus features

* Trademark of General Electric Co.

J. O. SWEENY, Manager—Product Planning, Distribution Transformer Department, and the components of a General Electric 25-kva distribution transformer.

General Electric distribution transformers feature Permalex insulation for 20% added loadability—*plus* important bonus features that can mean day-to-day savings in operation and maintenance. For example:

New Melalast finish on cover prevents costly animal-caused outages, eliminates need for guards or taping.

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Thyrite Magne-valve lightning arrester provides optimum protection against lightning surges.

Feature by feature, G-E distribution transformers offer you greater value for your dollar. Ask your G-E Sales Engineer for more details—and the 10 reasons why General Electric is your best transformer buy. Or write for bulletin GEA-6070, to Sect. 431-90, General Electric Co., Schenectady, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

230-Kv Line Has Light Towers (*Continued from page* 46)

The Type E tower is a strain tower required at the SEGCO end of the line to make transition from horizontal to vertical conductor configuration on the double-circuit, deadend tower. The tower-circuit deadend tower (Type F) is for a combination of all loads with a 2.0 overload factor and a torque condition with one circuit in place. The Type F tower will have only one circuit in place until a future 230-kv line is built.

Grillage Footings Used

Steel grillage footings will be on all towers except Type F, which will be placed only where ready-mix concrete is available. Concrete footings for the other towers were ruled out because most sites are not accessible for ready-mix concrete trucks.

As soon as the final tower spotting had been made, a two-man crew began soil exploration at the sites. They used a 4-in. earth auger and equipment for penetration tests. The specifications required that drilling and penetration tests be made at two footings of each tower unless rock was encountered. Where rock were encountered, all four footings are drilled. Holes were to be drilled to 8½-ft depth with penetration tests made from 8½ to 10½ ft. Where penetration was high, drilling was continued until good bearing soil was reached. The crew found that the actual time for soil exploration represented such a small portion of their total working time that all four footing locations of each tower were drilled. Most of the working time was spent in traveling between tower sites.

At some locations footing lengths longer than standard were required, or standard lengths would have to be set deeper to reach good bearing soil. The Type A tower footing was designed to fit in a 42-in. augered hole 8 ft deep. At many of the Type A tower locations shale was encountered, and the 4-in. auger would not penetrate more than 6 to 7 ft.

At such locations the individual tower loading was investigated and at those where uplift resistance would be adequate, a 6½-ft-deep footing replaced the 8-ft depth. At a number of locations rock was present at depths varying from 6 in. to 10 ft. For rock conditions, an adjustable length rock footing was designed. This avoided blasting which is expensive.

Can Be Dowelled to Rock

The adjustable footing is one in which the grillage is punched to receive dowels grouted in rock and the leg is punched so it can be burned off at any length and fastened to the grillage base. This footing can be dowelled to rock at any depth. On surface rock the tower leg can be bolted to the grillage base. No concrete is required, as the grillage base can be leveled with the grout required to set the dowels.

The grillage base provides both a means of spreading the dowels and a stub angle to which the leg angle can be connected.

Four adjustable rock footings for the Type A tower cost $240. Weighing the possible waste of steel against the possible losses incurred through construction forces awaiting mtaerials, or the cost of footings using concrete at roughly $150 per yd in place, the economics and advantages of the adjustable rock grillage can be seen.

Rods Were Tested

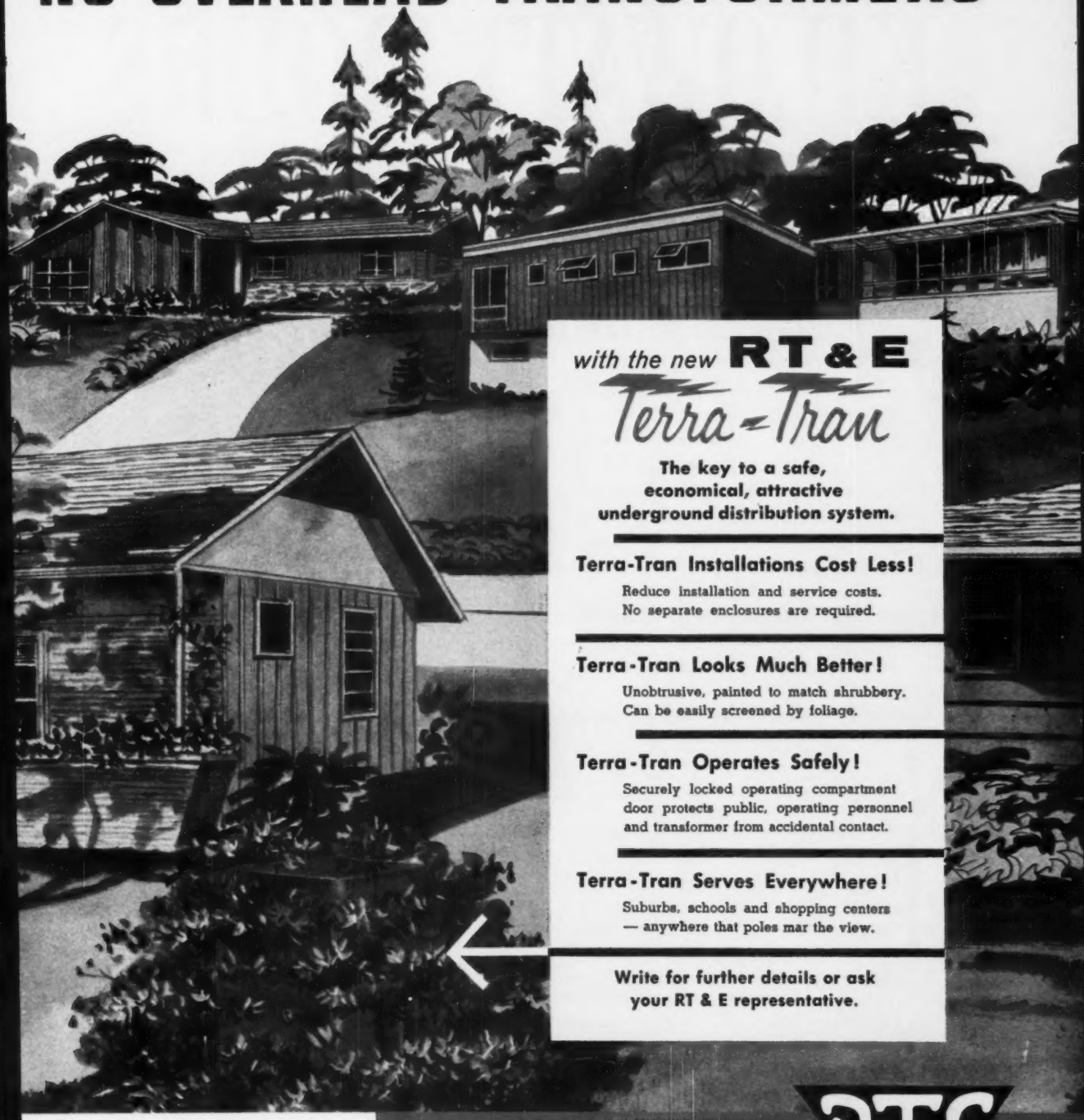
As there seems to be little published data on safe loads on dowels set in rock, or the required depth setting to utilize the strength of the dowel rod, this information had to be developed. Several ¾ in. dia, high-strength steel rods were grouted in sandstone rock at varying depths using 2 in.-dia holes drilled with an air jack hammer. Both galvanized and ungalvanized rods with and without nuts were used, and the grout was regular portland cement in some instances and a commercial mix expanding the grout in some others. After setting seven days the rods were tested by jacking to failure.

Table III—Uplift Test Data on Rods Grouted in Sandstone Rock

Type Rod*	Depth Of Rod In Rock	Hardware On Lower End Of Rod	Type Grout**	Uplift On Rod In Kips	Type Failure
A	3 ft–0 in.	Single nut	Field mix	40.1	Threads sheared out of double nuts at top of rod.
				36.9	Threads sheared out of double nuts at top of rod.
				40.2	Three nuts at top—rod slipped from nut in hole.
B	3 ft–0 in.	None	Pre mix	14.4	Bond was broken—rod began slipping out of grout.
A	3 ft–0 in.	Single nut	Pre mix	61.6***	Rod failed in threaded section just below double nut at top. Negligible slippage in grout.
A	4 ft–6 in.	Single nut	Pre mix	39.1	Rod failed in threaded section below double nut at top of rod
A	6 ft–0 in.	None	Field mix	31.0	Threads sheared from single nut at top of rod.
				31.8	Bond broken—rod began slipping from grout.

NOTES:
* "A" rod was a ¾ in. dia high-strength rod of C1055 steel with cut threads.
"B" rod was cut from a standard galvanized ¾ inch anchor rod.
** Field-mix grout was one part portland cement, two parts sand.
Pre-mix grout was a commercial mix expanding type grout containing iron filings.
*** This value seemed unusually high but no error could be found in checking.

NO POLES NO EXPOSED LINES NO OVERHEAD TRANSFORMERS



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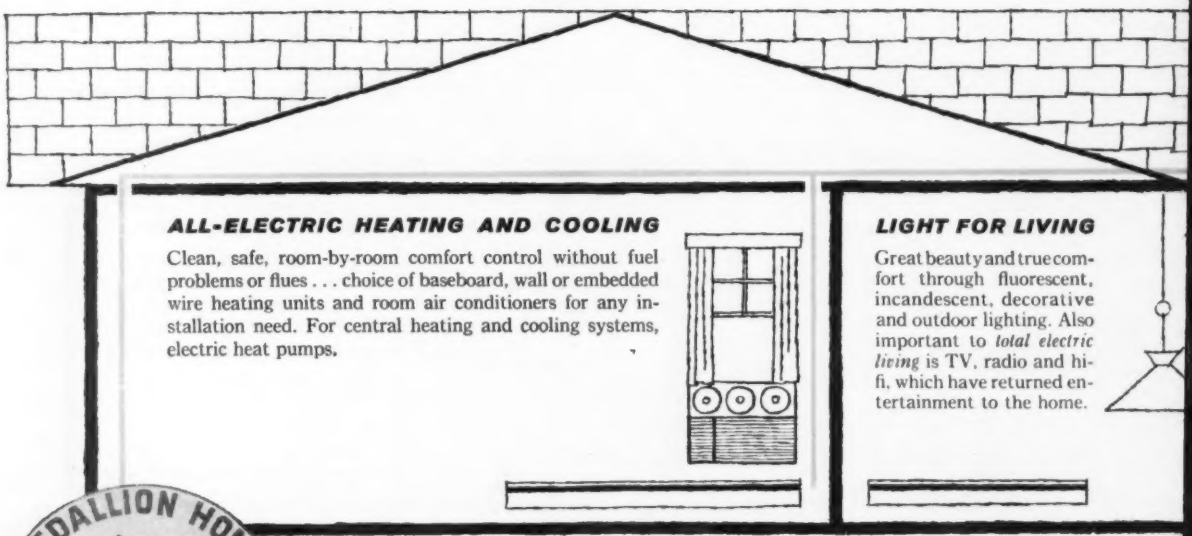

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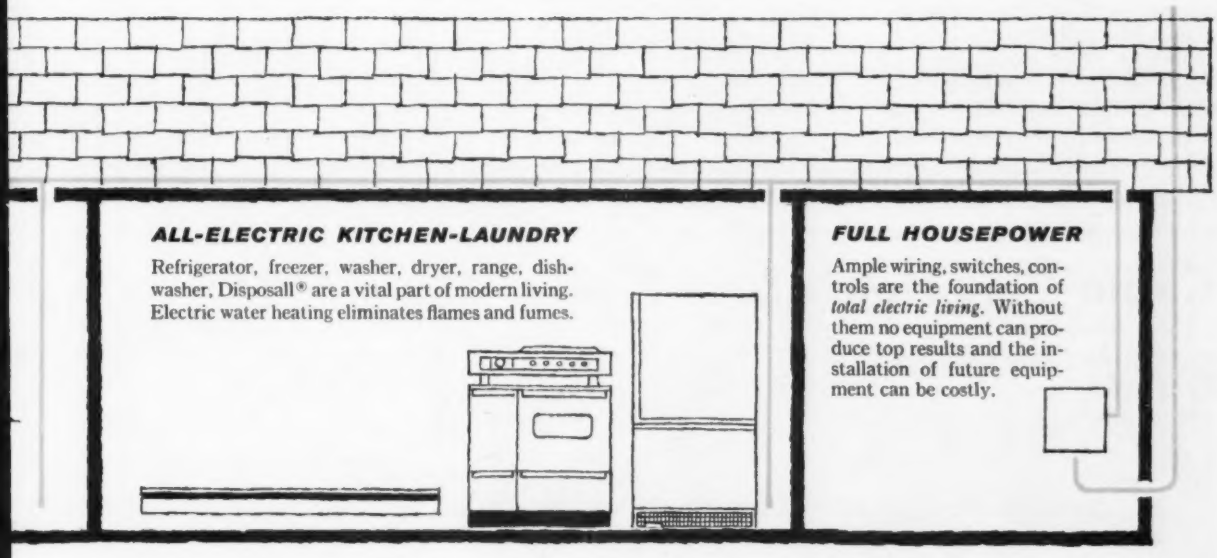
General Electric will support the program with full-color advertising in Life, Better Homes & Gardens, House Beautiful, House & Garden, New Homes Guide and House Beautiful Building Manual.

For an introduction to General Electric's program to promote Medallion Homes in your area, write for booklet 45-015EW.

Residential Market Development Operation, General Electric Company, Appliance Park, Louisville 1, Kentucky.

NATIONAL ELECTRICAL WEEK
FEB. 7-13, 1960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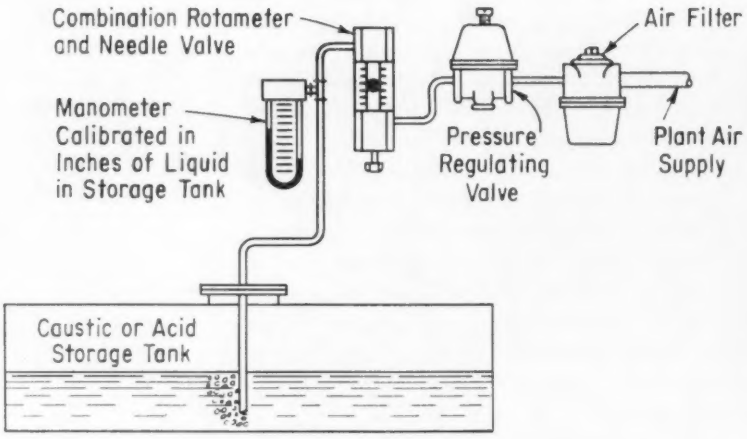

Combination Rotameter and Needle Valve
Manometer Calibrated in Inches of Liquid in Storage Tank
Pressure Regulating Valve
Air Filter
Plant Air Supply
Caustic or Acid Storage Tank

Inside Gages Read Chemical Tank Levels

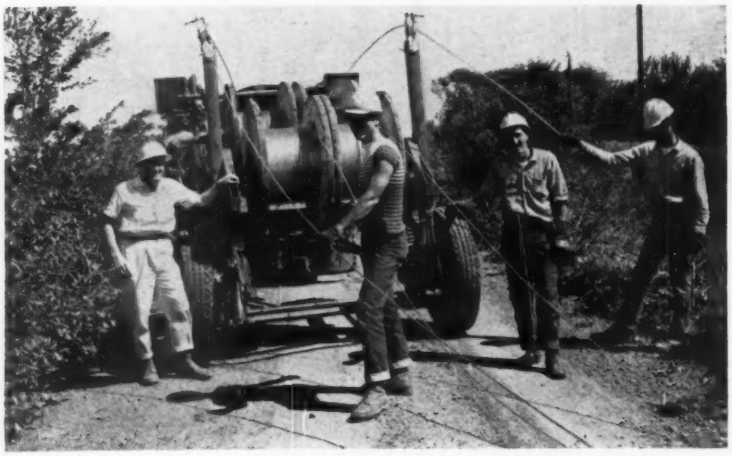
JAMES A. CUMMINGS, Production Dept, Detroit Edison Co, Detroit, Michigan

Detroit Edison Co uses indicating gages inside the building at ground level at the Marysville Power Plant to show the level of liquid in two chemical storage tanks outside the building. The tanks contain chemicals for demineralization of feed-water. Gages are connected as illustrated.

Compressed air, reduced to 9 psig, is passed through the rotameter and needle valve and then through $\frac{5}{16}$-in. copper tubing to a $\frac{5}{8}$-in. standpipe in the manhole cover in the storage tank. The standpipe reaches to within $\frac{3}{8}$-in. of the bottom of the tank, the air bubbling from the open end. Pressure necessary to force the air out varies with the fluid level above the open end of the pipe. This level is measured on the manometer. The $\frac{3}{8}$-in. tubes from the storage tanks to the manometers are of stainless steel to withstand corrosive action.

A separate installation was made for each tank. The two manometers have different scales because of the difference in density of the caustic and acid solutions. The 93% acid solution is 1½ times as heavy as the 20% caustic solution so its manometer scale is proportional.

Cable Cart Holds Four Reels



A cable cart which normally carries one large reel was adapted to carry four small reels for the stringing of four miles of four-wire 12-kv line. The adaptation was the idea of general foreman C. P. Morgan and line foreman Earl Shideler of Kansas Power & Light Co.

To make the four-reel rig, reel jacks were bolted onto the cart. Reels were set on the jacks with a boom. The 12-kv line went through pastures, wheat fields, plowed fields and thick underbrush. Thus, by stringing all four conductors at once, the job went faster and easier and damage to crops was minimized. The cart pulled by a line truck was easy to maneuver over rough terrain.

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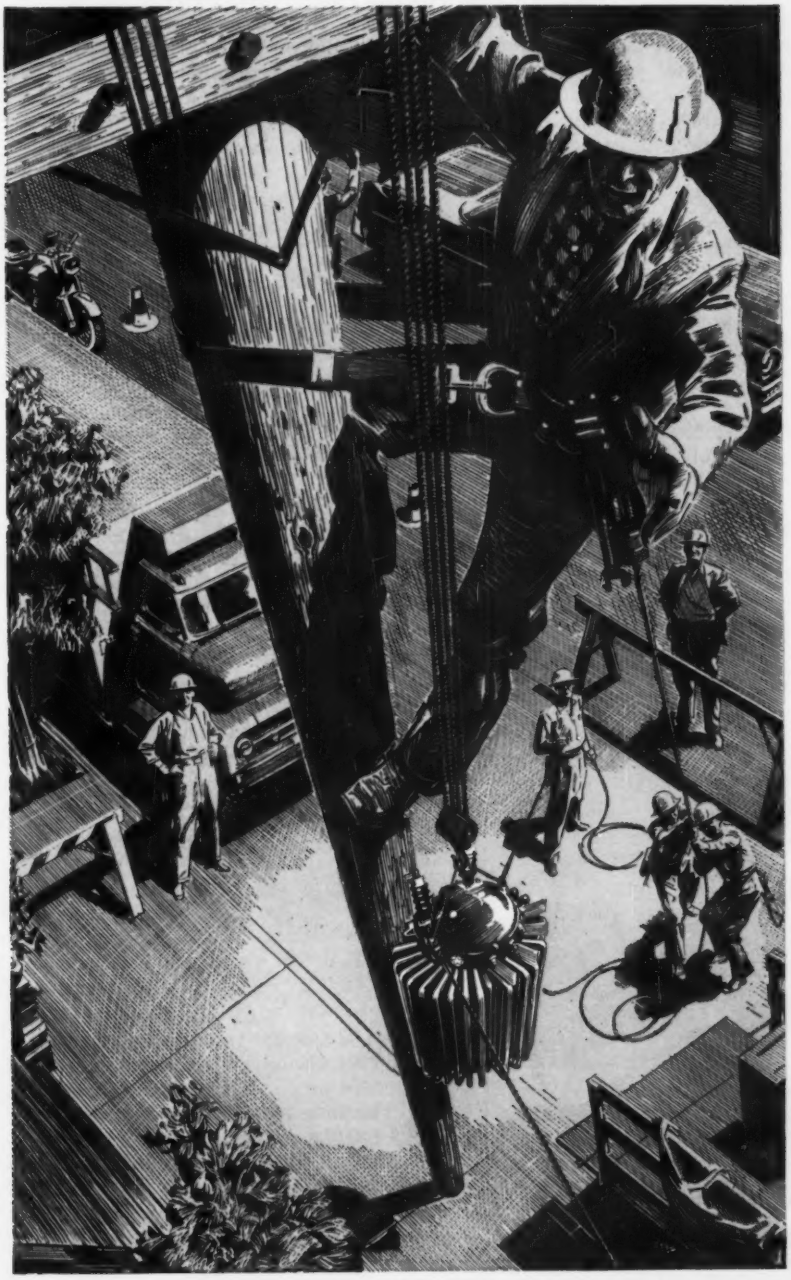

A Pennsylvania innovation that has rewritten the industry's standards

Pennsylvania first broke the "100-kva barrier" on pole-mounting in 1953, by introducing the 167-kva Featherweight Pole Star. This innovation was so emulated that industry standards soon were rewritten to include pole-mounting of higher kva units. Now, the *250-kva* Featherweight Pole Star is going up on poles from coast to coast . . . and a similar 333-kva unit for pole-mounting has just gone into production at Pennsylvania. Greater power per pole —at lower cost—is but one of the advantages. New Featherweight Pole Stars are easier to store, easier to handle, and easier to install. For facts and figures regarding specific ratings, contact Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

McGRAW EDISON

PENNSYLVANIA DISTRIBUTION TRANSFORMERS

Electrical Women Praised at LBE Conference

About 70% of the residential revenue utilities are receiving today reflects the results of the performances of home service women during the 14-year postwar period.

Robert G. MacDonald, vice president-marketing, West Penn Power Co, made this point at the Live Better Electrically Women's Conference last month in Chicago.

The Conference was sponsored by Edison Electric Institute.

Two out of five, or about 40% of customers being served today by electrical utilities, he said, have been added since World War II. And home service representatives have been working with these newcomers, "making them aware of what real electrical living would do for them."

Just about 100% of the dryers, television sets, automatic washers, dishwashers and house heating installations in use today are postwar items, as are 75% of the ranges and 85% of the water heaters, according to MacDonald, also chairman of EEI's Residential Group.

But, he said, the 8,000 kwhr-per-customer average annual use expected by 1975 is "not nearly good enough." This figure would not reflect total electric living on the part of enough customers and would mean "we have not played hard enough to substantially outscore our competitors."

To do this, more and more attention must be given to goods and services that take customers in the direction of total electric living, MacDonald noted. "And most of us feel that today indoor climate control—heating and cooling—is the immediate key to progress."

He urged his listeners "to paint the picture of total electric living so vividly that customers will not only begin to accept it—they will demand it." Selling total electric living "boils down to your use of proof that immediate and long-range benefits are worth more than today's price." Only through effective sales methods can customers' objections, "I cannot afford to buy it;" "I cannot afford to operate it;" or "I have a perfectly good competitive service" be overruled.

Utility home service women must not only sell total electric living, pointed out MacDonald, but also must sell the private enterprise system and their company's services.

John H. K. Shannahan, assistant vice president, American Electric Power Service Corp, pointed out to conferees that "we have reached the end of a period in which electric heating was beginning to take hold, and that means that it is now a way of life . . . It is a way of life for the customer and the utility . . . It means that our concept of an all-electric home has very quickly jumped from 10,000 kwhr a year to 25,000 kwhr a year . . . 25,000 kwhr per year begins to add up very rapidly, and in no time at all a small percentage of heating customers is beginning to make its presence felt in revenue and in kwhr per customer.

Electric Heating Saturation

"For instance, a 1% saturation of electric heating will add 150 kwhr per year to your average customer's use. To equal this, it would take a 10% increase in range saturation, or a 4% saturation increase with the water heater. An electric utility with an existing range saturation in the neighborhood of 50 to 60% will find it very difficult to push that saturation up an additional 10 points—and in fact that kind of a range saturation indicates an acceptance of electric living that would make a 1% heating saturation a far easier and surer means of achieving the increase in customer usage."

Shannahan named as "new allies" the insulation industry, which is showing an increasing interest in the electric heating market, and FHA and other lending agencies which are no longer looking askance at loans for electric heating.

He warned, however, that the competition is "going to keep the heat on . . ." For the first time the heating market they thought was inviolate is being threatened and utilities have to sell electric living harder than ever.

Ralph Zeuthen, manager of LBE, pointed out that the housewife does 90% of the buying and the home service woman, in contacting her, has a distinct advantage.

SHARING VIEWS ON ROLE OF WOMEN in the electrical industry for residential revenue growth are (l to r): C. E. Anderson, mgr sales promotion, Virginia Electric Power; R. G. MacDonald, vp-marketing, West Penn Power; and J. H. K. Shannahan, asst vp, American Electric Power Service Corp

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Metropolitan Style 72 is the first of a series of new Pemco Fluorescent Luminaires. Cat. No. 72-804 is for use with four 72" 800 MA lamps, Cat. No. 72-154 for four 72" 1500 MA lamps.

Housing is of one-piece moulded gray fibreglas — no painted surface to fade or peel. Pemco's specular reflector assures maximum utilization of light output and proper direction of light. One-piece moulded heat-resistant clear acrylic enclosure eliminates possibility of cracks from cemented joints. Luminaire is rigidly reinforced throughout. Request Bulletin 125 for complete information on the Pemco Metropolitan Style 72 Fluorescent Luminaire.

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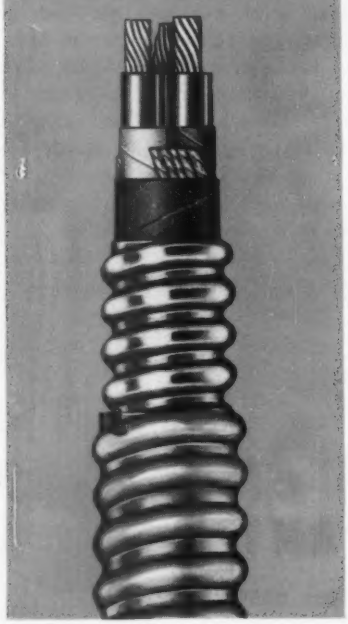

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Simplex C-L-X pliable cable systems provide unexcelled ease of installation and mechanical protection.

The *corrugated* metal sheath combines pliability for ease of installation with very great strength and seals the cable against penetration by oil, chemicals and moisture.

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Light, and pliable, C-L-X cables are easily installed, and require no special reels.

Now, with corrugated *Aluminum*, *Copper* or *Bronze* sheathed C-L-X cable systems, the low resistance of these metals permits designs where the sheath may be used as a neutral or ground. These metals also permit the use of single as well as multiconductor cable assemblies in a-c power systems.

For complete details on C-L-X sheathed cables, contact your Simplex Engineer, or write direct.

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When Are "Rights" Wrong?

Report on Finance

Subscription rights or public offering—which is best? That is just one of the many questions that utility financial men worry about when they go after new equity dollars. And like most other financial questions, the answer to this one is not black, not white, but something in between. Each method has its advantages and its disadvantages too. Unfortunately, some companies already have this decision made for them: Rights are mandatory under their state laws.

Nevertheless, there are rooters for both sides. Lets call them the "Rightists" and the "Public Dealers." Both are ready to advance arguments for their side, and both stir up some controversy when they do. A financial manager who listens to these arguments may not wander from his own position, but he is bound to have more raw material to make a decision that best suits the needs of his company.

There are, of course, two ways a company can raise new common stock capital. On one hand it can simply sell new shares on the open market, paying an underwriter to do the selling job and to guarantee that all of the new stock gets sold to the public. That's how the "Public Dealers" like to do business. On the other hand the company can sell the new shares to its own stockholders by sending them subscriptions through the mail. If so, in order to induce its stockholders to buy the new shares it gives them the "right" to buy at a discount. That's the proper way, according to the "Rightists".

Basically, the "Rightists" will tell you that their method of selling new shares is a wonderful way to strengthen stockholder and investment dealer relations. Furthermore, they say, the overall cost of selling new shares by subscription, including underwriting fees, is less than the cost of going to the public market with the new issue.

But the "Public Dealers" don't agree. The risks simply aren't worth it, they explain. First, because a subscription sale involves fixing the price of the new

stock during the subscription period, and that involves a big risk to the company if the market skids downward. Secondly, the "Public Dealers" say, rights have traditionally involved issuing new stock at less than the going market price. That means you have to sell more shares to draw in the same amount of capital. And more shares will reduce per share earnings, lower the market price of the stock and make it harder to increase or support the dividend. This, they warn, can be very dangerous for a company whose earnings prospects are already poor.

Both sides, it turns out, have a hard job presenting convincing statistics to back up their claims or to prove their method will work best in the majority of cases. There are simply too many intangibles on both sides.

The discount that a stockholder gets on a rights issue is automatically offset by a dilution of his shares. Per share earnings will drop, since more shares had to be sold to raise the same amount of capital by subscription. The "Rightists" will admit that. But investors don't see it that way, they are quick to add. Instead, an investor thinks of the value of his rights as a sort of "extra dividend." Of course, it isn't a dividend in any sense of the word, and the "Rightist" will probably admit that too.

This "extra dividend" can be an important sales pitch, the "Rightists" maintain. Securities salesmen, like salesmen everywhere, like to sell stocks that "move." And this "extra dividend" selling argument for stock with rights makes it somewhat easier to sell than comparable stock without rights. This argument that the "Rightists" present should especially interest a fast growing company that has to come to the market often for new equity capital.

But a public offer means broader ownership, providing a wider market in the future: A strong counter point for the "Public Dealers." There is no guarantee that dealers will push stock with rights, they say. And even if the dealers do, the broader market that a public issue creates makes it easier to sell new stock in the future.

The costs are higher on a rights deal, the "Public Dealers" assert. A huge mass of prospectuses has to be printed and mailed out on a rights issue since every stockholder has got to receive one. This could run to 50,000 or even more individual mailings. Then too, bank charges for handling all these subscription rights can be sizable. Most of this expense, the "Public Dealers" say, is absent in a public deal.

Not so, say the "Rightists." Underwriting fees on a public offering will bulk larger. In a rights deal only a fraction of the stock will have to be sold through underwriters—most of the shares are picked up directly by the stockholders. The "Rightist" will admit, though, that he must pay a standby fee to the underwriter, who agrees in turn to pick up all the shares the stockholders don't buy. The "Rightists" also pay a fee for distributing the unsubscribed stock. Still, the "Rightists" contend these combined fees on a rights deal seldom equal the high underwriting fees on a public issue.

The "Rightists" are probably correct in saying that total expenses of all kinds are generally lower with a rights offering. And this balance in favor of the "Rightists" tends to get even more favorable for larger issues. That is because the underwriting fees usually increase proportionately with the number of shares sold in a public offering, whereas the "other" expenses in a rights offering become proportionately lower as the size of the issue increases.

The discount on a rights offering is not a true expense of the transaction in the eyes of the "Rightists." It simply redounds to the benefit of the stockholders. Their shares are worth less after a rights issue. But the stockholders have cash in hand, or new stock they bought at a discount, to offset the dilution from the

rights issue. Of course, some rights will be neither exercised nor sold, but that amount is nominal—probably no more than 0.25% of the proceeds.

Underwriting fees are much lower in a good market, the "Public Dealers" say. But the "Rightists" come back with the fact that underwriting fees in a poor market will be high, although they must admit that standby fees in a poor market will be high as well.

Actually, cost comparisons between the two methods don't make much sense. Underwriting fees and other costs vary too much from issue to issue and from company to company, depending on market conditions. Comparisons and statistical averages are impractical and unrealistic, even though many companies have made studies that "prove" one or the other method is less costly.

The "Rightists" have another argument. They say the dilution in per share earnings that occurs in a rights offering benefits utilities making a high rate of return on investment by lowering per share earnings and dividends. For example, take a company that made a one-for-ten rights offering every year for 10 years, each time at a 10% discount from market. Here is what would happen after 10 years. Per share earnings would be $1.36 with rights, compared to $1.60 per share if the stock had been offered publicly. This assumes earnings will increase 5% each year. At 75% payout, dividends would be only $1.00 per share with rights, but $1.20 per share on publicly offered stock.

Maintaining Stockholder Equity

Pre-emptive rights have a long history. Originally, when companies were very closely held it was vital for stockholders to maintain their equity by buying up a pro-rata share of any new issue of stock. They had no centralized market to deal through. It was unethical, sometimes even illegal, for a company to offer new shares to outside investors before the existing owners had a crack at the issue. For most large companies today this argument sounds weak. Now an investor can step into the open market and buy any portion of the new shares he wants. But there still remains, say the "Rightists," vestiges of this old concept—failure to follow it may well bring down a rash of stockholder ill-will. And if stockholders are guaranteed pre-emptive rights in the company charter, they say, any attempt to alter it may prove unwise indeed.

The ill will from stockholders when a company goes from a rights to a public offering isn't likely to be serious if a new issue hasn't been made for a number of years. But if a company has made a lot of new rights offerings (for example eight issues in ten years) there may be repercussions in a switchover to a public deal. The stockholders are used to the "extra dividend." They are bound to complain if they lose it. This does not mean it is impossible, or even inadvisable, to switch from one method to the other. Generally, stockholders will follow management policy if they get a reasonable explanation and are happy with their investment. Actually, of two large electric companies that recently made the switch from rights to a public offering, one received only 10 complaints, the other just 43. Certainly not an alarming reaction.

Some Other Factors

Rights must have a reasonable value or they simply offend stockholders and dealers. Stockholders expect a reasonable discount in a rights offer—in fact they expect a "bargain." And if the "bargain" isn't as advertised they naturally resent it, feeling they have been put to trouble for nothing at all. Rights have got to be worth enough so a dealer can earn a fair commission on their sale and still leave enough cash to satisfy the investor.

Three factors determine whether rights are worthwhile or not: (1) Offering ratio, (2) Discount and (3) Market conditions. Here is a rule of thumb: Rights should sell for at least 10¢ apiece to make handling them worthwhile. A more-or-less normal offering ratio might be one new share for every ten old ones. A reasonable discount (over the last 10 years) would be about 8% off market price. For example, take a stock selling at $30.00. An 8% discount would be $2.40 per share. Thus, in a one-for-ten rights offering the rights are worth 24¢ apiece, which is adequate. Holders of 100 shares (which is about half the average holding for American investors) would find their rights worth $24.00.

But with a very low offering ratio things get pretty lean for the stockholders. With, say, a one-for-25 offering ratio and a discount of only 5%, a holder of 100 shares would find his rights worth just 6¢ each—a total of $6.00. Holders of less than 100 shares would obviously fare much worse. If the stockholder sold the rights instead of exercising them his dealer might have to forego a commission or else risk offending his customer by leaving him almost nothing after the transaction. Good will is likely to tumble.

For that reason, many companies elect a public deal if the offering ratio drops much below one-for-20, or even one-for-15. Unless, of course, a rights issue is mandatory by state law or by the company's charter. That way, the company avoids having the rights sell at ridiculously low prices.

Some companies, bound by their charters to issue new stock by subscription have tried to amend this provision so they can go to the public market if the offering ratio is very low, say one-for-25. Some have found it difficult to convince their stockholders that even such a reasonable concession as this is advisable. Stockholders as a rule are jealous of their pre-emptive rights.

Paradoxically, a very high offering ratio can be just as damaging to the success of a rights issue as a very low offering ratio. A stockholder can tear open an envelope and find a rights certificate inside that entitles him to one new share for every three he holds. But he simply may not have the cash to increase his investment by one-third. Thus, as a group, the stockholders will not pick up as many shares, in turn leading to more distribution by an underwriter and correspondingly higher standby fees.

An uncertain market gives the "Public Dealers" one of their strongest points to pound home. In a public offering the new shares are generally snatched up quickly once the price is fixed. A rights offering, on the other hand, takes longer to complete. The stockholders have to receive the rights, decide what they want to do with them and then return them to the company agents with the subscription funds. Generally, two weeks is an adequate time allowance for stockholders to exercise their rights. But in a market that is threatening to break downward two weeks can be a very long time. The company may have to pay handsomely to induce an underwriter to stand by on the new issue. In the past it was the practice for industrials to give much longer periods, sometimes even a month. But these offerings were not underwritten.

Underwriting fees, of course, can be dispensed with if the issuing company has no pressing need for new funds. In such a case the company can ride with the market to take advantage of the most favorable conditions.

Both the "Rightists" and the "Public Dealers" argue in general terms, and neither is always correct or always incorrect. No general recommendation is feasible because the question of stock rights—like the question of the "ideal" payout or common equity ratio—doesn't make sense until the discussion is narrowed down to a specific company with its own management goals. Whatever it may be, the final answer will always involve a compromise of interests.

FLY ASH ▶ **Indiana Electric Assn has launched fly-ash research project** to study characteristics of mechanically collected ash and determine possible uses. The Association has already signed a $9,000 contract with Purdue University Research Foundation for the first phase of the project. This will consist of a study to determine how the physical and chemical properties of the various mechanically collected fly ashes in Indiana differ from the electrostaticly collected ashes now being used extensively as admixtures in concrete. A second study will determine the effect of these characteristics upon the mortar or cement properties of fly ash.

Second phase of the research project will be made essentially to determine how the Indiana fly ash can best be utilized. Extent of this second phase is still to be determined, but it may seek to determine whether concrete made with mechanically collected fly ash actually does require more air-entraining agent than concrete made with electrostatic fly ash, and what the effect of such an agent has upon the concrete produced.

SUPPLIERS ▶ **Five-Week strike at Pennsylvania Transformer has ended for 900** production and maintenance workers with the signing of a contract with the United Steelworkers of America. Fifty electrical testers were still on strike as Electrical World went to press but settlement was expected momentarily. The three-year contract will cost the company 34¢ an hour per worker over the period. But the company says that it has retained and expanded management prerogatives.

General Electrics Co's move to split its apparatus-industrial group into separate segments was made "to improve focus on customer problems and take full advantage of growth opportunities," explains GE President Robert Paxton.

COPPER ▶ **Copper production capacity is estimated to increase 16%** between 1958 and 1963 according to the Copper & Brass Research Association. U. S. will continue to be the largest single producer with Africa running second, and Peru making a significant advance in its relative position.

STEEL | **While purchasing men speculated on the size of a prospective steel price increase,** buyers of hot rolled carbon steel in St. Louis got an unexpected bargain—a reduction ranging from $5.40 to $7.20 a ton. But industry men characterized the cut as a purely local development.

News of Manufacturers ..... page 64
New Equipment ..... page 70
Readers Service ..... page 71

Worthington Launches Steam Symposiums

In a move designated "to promote closer working relationship with the electrical utility industry" Worthington Corp will hold a series of nation-wide steam power symposiums over a number of years. This year, the symposium package and company representatives will travel to utilities in about 15 U. S. cities. This is the first major long-range technical communications effort Worthington has made which involves trips by key executives to utilities. The first presentation was held on January 22 for the Public Service Electric & Gas Co in Newark, N. J.

Forty percent of Worthington's Harrison division sales are to utilities. "We found that both the utility company and we could profit by better communications on products and applications," said J. B. Laramy, Harrison division sales manager, after findings from an intensive survey of utilities in 26 cities were pooled by an independent research team commissioned by Worthington. Both utility customers and non-customers were queried as to their needs and how these needs might be affected by supplier services. "We could learn more about how to use our capabilities and at the same time find out how to better serve the utilities," added Laramy.

New application concepts, as well as the latest background on steam power plant fluid-handling equipment, will be covered in the symposiums. For it was discovered through the survey that, not only did Worthington need to increase the scope of its own product story, but there was a need for visualizing and describing to utilities new application concepts. The need for keeping utility costs down must be met through creative engineering trends, Worthington recognizes. "However," said Laramy, "only when you have taken these trends and made them reliable, can you provide a product both economical and dependable."

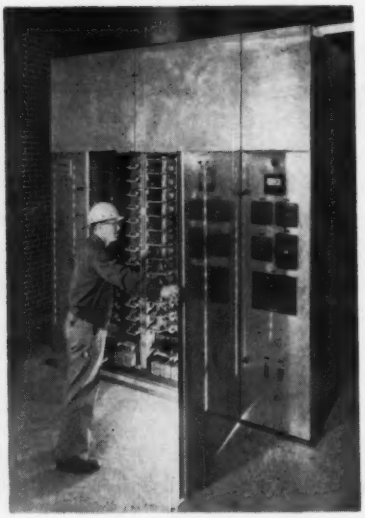
Symposium Highlights Trends

Four major trends in the utility industry are treated in the slide-film segment of the symposium: higher operating temperatures and pressures; the use of larger turbine-generator units; super-pressure steam plants; and the use of nuclear fuels. Since 1929, Worthington points out, temperatures have gone from 750F to 1,200F. Pressures have risen even more spectacularly, going from 500 to 5,000 psi in the same 30-yr period. Although forecasts predict that by 1975 approximately only 5% of our electrical power will come from the atom, appropriate power plant trends must be dealt with now.

Worthington says it is meeting the demands of these trends and gives as some examples its boiler feed pump designs, including the high-speed boiler feed pump at 9,000 rpm; the packless stuffing box, boiler feed pumps without a spare, steam turbine drives for boiler feed pumps, and main generator shaft drives.

The symposiums will consist of a wide-screen, color-film presentation, a series of visual demonstrations, individual product presentations and discussions by key Worthington executives. Seven representatives from Worthington's Harrison division traveling with the package will be joined in their participation by key local personnel.

Improved 6,000-Kw Silicon Rectifier Unit Developed



A three-year joint development project of Aluminum Co of America and Westinghouse Electric Corp has produced this 6,000 kw, 10,000-amp, 600-v silicon rectifier unit (near left photo). Both companies report it has greater current-carrying capability and higher efficiency than any previous large silicon rectifying equipment.

Using only 312 silicon cells (shown in pile in far left photo), the new unit provides a power output almost equal to the 6,825-kw, 525-v rotary converter shown in the background, yet takes up only one-third the space.

Over-all efficiency of the new static converter is over 97%. Use

(*Continued on page* 66)

Hundreds of thousands of feet later—and still

no failures of ROEBLING TELLURIUM LEAD ALLOY SHEATH!

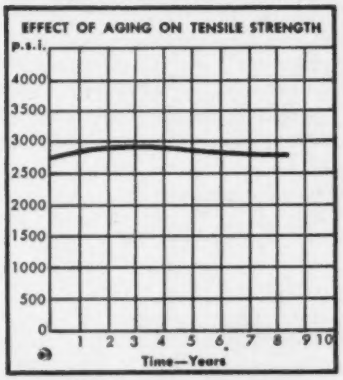
More proof: Tensile strength and elongation remain virtually unchanged, after eight years aging.

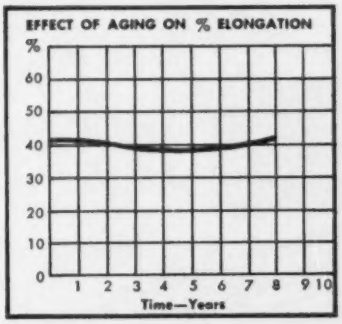
The first Roebling Paper Power Cable with the extraordinary Tellurium Lead Alloy Sheath went into service over five years ago. Since then hundreds of thousands of feet have been put to work. The record? Not a single failure! This remarkable record of service on energized circuits proves conclusively that Roebling Paper Power Cable with Tellurium Lead Alloy Sheath gives you maximum service, with maximum savings!

What's more, we asked the people who bought this cable to put it into the toughest service possible—in such installations as high risers, grades and underground installations where large cable movements and high temperatures prevail. And this gruelling service bears out what we've always maintained: Roebling Tellurium Lead Alloy Sheath has long term stability when it comes to tensile strength and elongation, high resistance to creep and bending fatigue.

These graphs of laboratory tests show effect of aging on tensile properties of Tellurium Lead Alloy Sheath.

TELLURIUM LEAD ALLOY SHEATH...



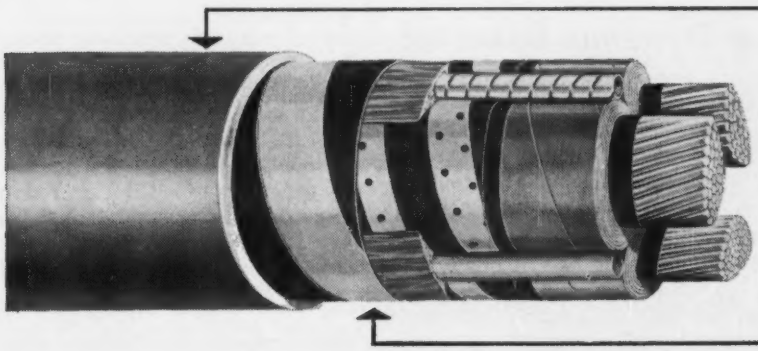


The exceptional quality of this sheath is one reason why Roebling has more Tellurium Lead Paper Power Cable in service than any other manufacturer. *Another* reason is the superb *inner* quality of this cable. Every step of construction represents scrupulous care. The paper tapes, for instance, are applied under uniformly controlled tension, to assure maximum insulation qualities. And every inch of the cable is tested—then tested again.

You benefit in all kind of savings—not the least of which is *money*—when you put Roebling Paper Power Cable with Tellurium Lead Alloy Sheath into service! Don't you owe it to yourself, and your company, to find out more? An interesting, profusely illustrated book is yours free. Write for your copy ...right now! Ask for Technical Bulletin 205-C. Roebling's Electrical Wire Division, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation



Uniform physical properties are easily achieved in a single operation with the tellurium alloy. This unique feature is but one of several which distinguish the tellurium alloy from other fatigue-resistant lead alloy sheaths.

Mammoth new taping and cabling machines, and the finest obtainable materials, are used to produce the carefully constructed "heart" of Roebling Paper Power Cables.

Improved Silicon Rectifier Unit Developed (*Continued from page* 64)

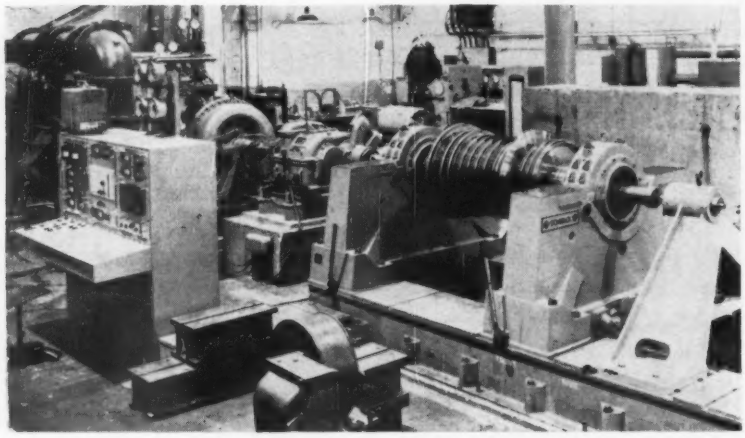
by the aluminum industry would permit the production of up to 4% more primary aluminum per unit of electricity consumed, Alcoa says.

Westinghouse claims that the unit requires about one-third the floor space of other types of rectifying equipment having a similar rating, and that it is comparable in physical size to previous silicon rectifying equipment having only half the output.

Both the new and old units are installed at Alcoa's Badin, N. C. smelting works. The old rotary units went into service in 1918. Approximately 60% of the entire weight of the new assembled silicon converter comes from the use of aluminum. Westinghouse says the new unit will be practically maintenance-free.

MANUFACTURERS BRIEFS

Philadelphia Electric has ordered from **Minneapolis-Honeywell Reg Co.** a $1¾-million electronic data-processing system, the Honeywell-800, capable of handling 96,000 decimal digits a second. It will be applied initially to billing and accounting services; later, it will be applied to other record-keeping activities and also to engineering, operating, and economic studies. Delivery is scheduled for late '61 . . . **Continental-Diamond Fibre Corp,** subsidiary of The Budd Co, now has permanent sales representation in Europe: Rene A. Amrein, a member of The Budd Co International Div (handling CDF's export sales). From Munich, Germany, he will cover all of Europe. CDF's products will also be shown for the first time at the 1960 Hannover Fair held in Germany . . . **Westinghouse Electric Corp's** engineers in the atomic equipment department recently built a new "twin-loop" test facility for canned motor pumps designed for controlled circulation boiler applications. Fluids at temperatures up to 500F can be pumped through the unit, which supplements high-temperature, 2,000-psi test loops. Without changing the basic configurations of the loop, the full line of canned motor pumps can be tested. The loop can be adapted for testing 4160-v pump motors, as well as the standard 440-v type. It was previously necessary to weld each pump volute into the loop and make special modifications to the loop before testing could proceed. Designed for double-discharge piping, double-discharge pump volutes can now be tested under operating conditions . . . **A. B. Chance Co** has made available to its customers color-coded cartons for its 8-way expanding, never-creep and cross-plate anchors. Packaging the anchors in cartons makes possible shipment on expendable pallets, and utilities may use mechanized material-handling equipment for unloading and storage . . . **Multi-Amp Electronic Corp** has built a mobile exhibit to display its newly designed standard line of protective-device test units. It will tour to electric utilities, REA operations, and industrial plants in the Central South initially, and later to the northeast area of the U.S. Test units can be operated when energized. The mobile exhibit also will visit potential customers on prearranged dates . . . **Ultrasonic Industries, Inc,** has been formed and will be established "to bring the price of ultrasonic cleaners down to a realistically low level by employing the merchandising and manufacturing techniques which have proved so successful" for mass-produced consumer appliances. An ultrasonic cleaner for $99.95, lowest priced unit on market is now offered.



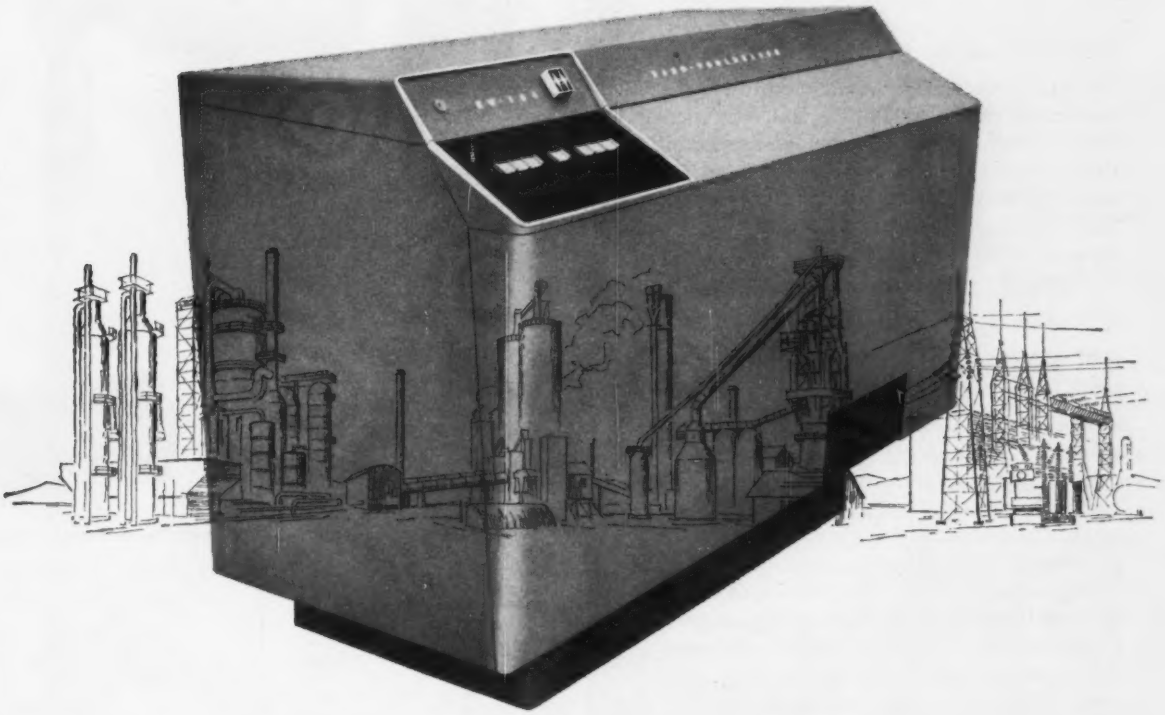
De Laval Installs New Dynamic Balancer

A high-speed dynamic balancing machine, claimed to be the largest in the United States, (shown above) has been installed by De Laval Steam Turbine Co. Capable of balancing 7-ton rotating units at 12,000 rpm, the machine is sensitive to bearing vibrations of the order of four-millionths of an inch displacement of the center of gravity. It can readily detect, for example, on a 5,500-lb rotor spinning at 4,000-rpm, unbalance as small as one gram at a 10-in. distance from the axis of rotation, De Laval says. The German-made machine will be used by the company for minimizing vibration of its rotary equipment and investigating the behavior of shafts and rotors at high speeds.

(*More Procurement & Products, p* 70)

In a Class by Itself

FOR CLOSED-LOOP CONTROL AND AUTOMATIC DATA REDUCTION



The RW-300

DIGITAL CONTROL COMPUTER

OPERATING SYSTEMS incorporating the RW-300 for on-line control and data reduction are demonstrating these tangible benefits: *reduced costs, increased output, improved quality.*

HIGH RELIABILITY, inherent in the advanced design of the RW-300, is being proven by thousands of hours of dependable operation.

SYSTEMS ENGINEERING staff, experienced in the analysis of complex control and data reduction problems, is assisting industry with applications of the RW-300 in chemical, petroleum, steel, cement, electric power, and other fields.

NATION-WIDE SERVICE organization is providing skilled maintenance for this completely developed, production engineered, and thoroughly tested piece of *industrial* equipment.

For further information, call or write Mr. Raymond E. Jacobson, Director of Marketing, The Thompson-Ramo-Wooldridge Products Company, 202 N. Canon Dr., Beverly Hills, Calif., BRadshaw 2-8892.

THE THOMPSON-RAMO-WOOLDRIDGE PRODUCTS COMPANY

a division of ***Thompson Ramo Wooldridge Inc.***

Only Grinnell has a complete line of pipe

WITH 8 . . . 9 . . . even 10 inches of thermal movement not a bit unusual in today's high temperature piping systems, complete support for piping in all positions of travel is vital.

SAFETY OF ENTIRE SYSTEM AT STAKE

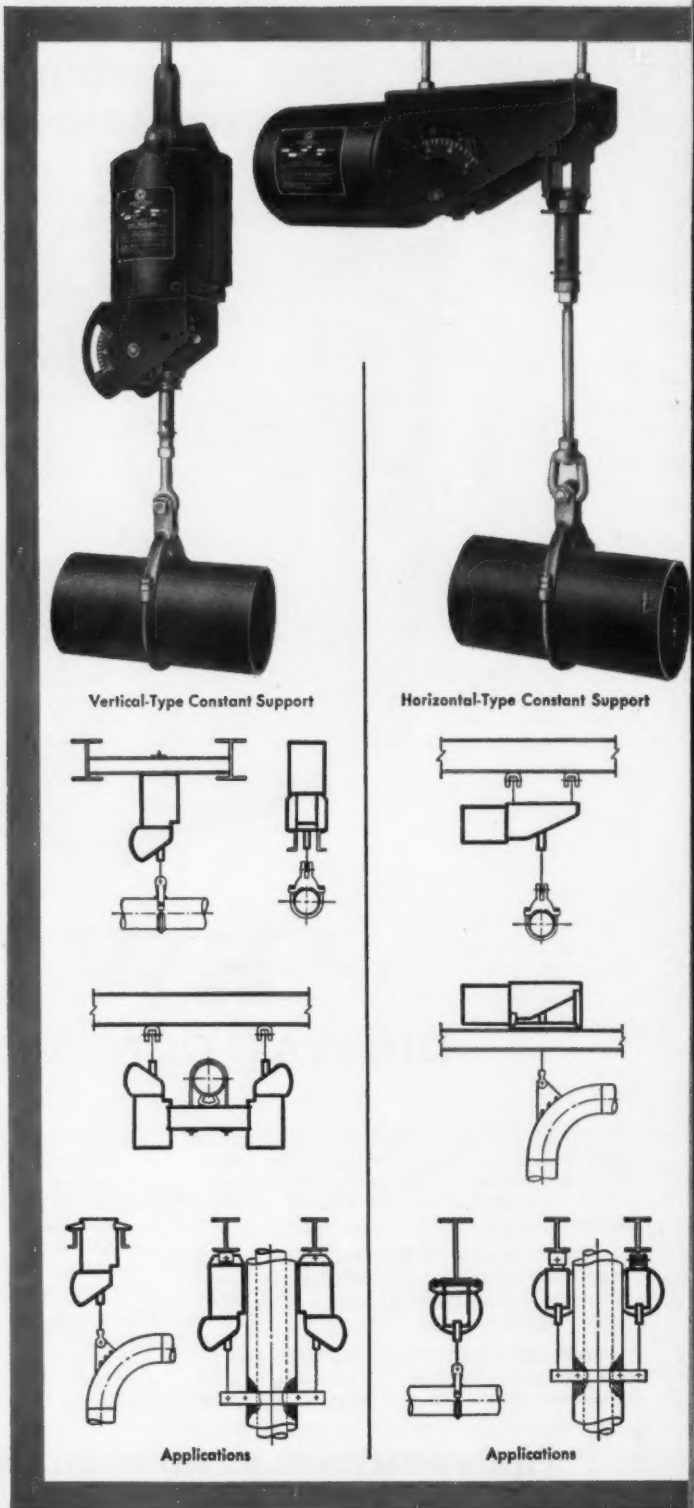
Helical coil springs are widely used to provide for thermal expansion. But the design or selection of flexible supports often is haphazard. Unless careful study is given to the design and choice of spring supports, the transfer of weight from one hanger to another, or from hanger to terminal points, can endanger the safety factor of the entire system.

MATHEMATICALLY PERFECT GRINNELL CONSTANT SUPPORTS

Grinnell Constant Supports are the result of a century of experience in the industrial piping field. A patented geometric design, exclusive with Grinnell Constant Supports, assures mathematically perfect load support throughout all positions of travel. There is also a full 70 percentage points of adjustability built into them. No less than 10 percent of this adjustability is allowed either side of calibration for plus or minus change in load. Field readjustments are easily made by turning a single load adjustment bolt. These hangers are designed to provide uniform supporting force equal to the pipe load throughout the travel range — and should be used at selected points on critical lines, as for example at turbine connections.

Available in 11 Different Types

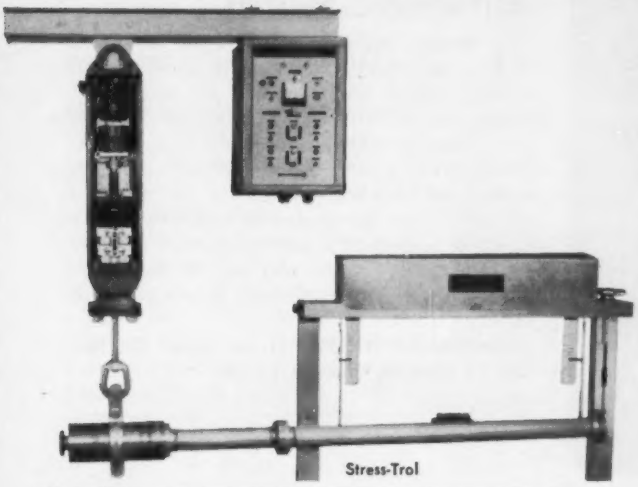
Grinnell Constant Supports are available in eleven types for a complete choice of mounting positions; above, between, or below structural steel. This choice includes both vertical and horizontal design to fit compactly into available headroom space. Even with this wide choice, Grinnell Constant Support Hangers provide mathematically perfect support through *all* ranges of travel, regardless of field adjustments.



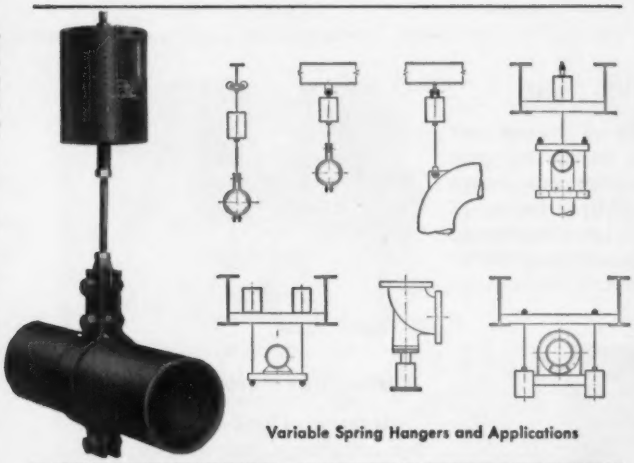
GRINNELL

AMERICA'S No. 1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

hangers to provide for thermal expansion

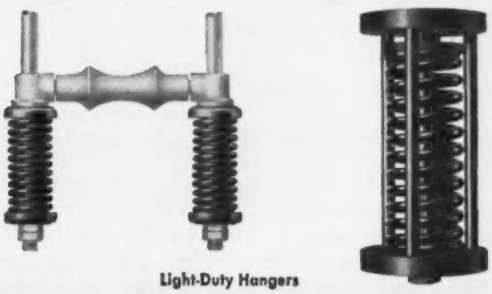


Stress-Trol



Variable Spring Hangers and Applications

Vibration Control and Sway Brace



Light-Duty Hangers

GRINNELL STRESS-TROL* FOR POSITION AND/OR LOAD CONTROL

Keeping the footage of high pressure-high temperature fabricated piping to a minimum has become important because of high piping costs. This can be accomplished by reducing the length of long expansion bends, but providing support for shorter, less flexible lengths of piping presents a new problem. Grinnell Stress-Trol, a motor operated device, solves this problem. It provides:

Position Control — that minimizes stresses in piping and reactions on connected equipment.

Load Control — that is constant support with unlimited load and travel capacities.

GRINNELL VARIABLE SPRING HANGERS

When pipe lines are subject to relatively small vertical movement, and do not require a constant support type hanger, Grinnell Variable Spring Hangers are available. The maximum variation in supporting force for standard spring models per ½ inch deflection is 10% of rated capacity. Grinnell offers these hangers in 21 sizes — in short, standard and double spring models, plus a special corrosion-resistant model. There are 7 different methods of attachment.

GRINNELL VIBRATION CONTROL AND SWAY BRACE

When necessary to prevent undesirable movement in lines, Grinnell Vibration Controls and Sway Braces of the energy storing and instant-acting counter force type are recommended. They dampen vibration, oppose pipe sway and absorb shock.

GRINNELL LIGHT-DUTY SPRING HANGERS

Finally, simple and inexpensive adjustable light-duty spring hangers often are all that's required to support piping safely. Grinnell has a complete line of light-duty hangers. They are designed for easy installation and quick, accurate alignment of piping.

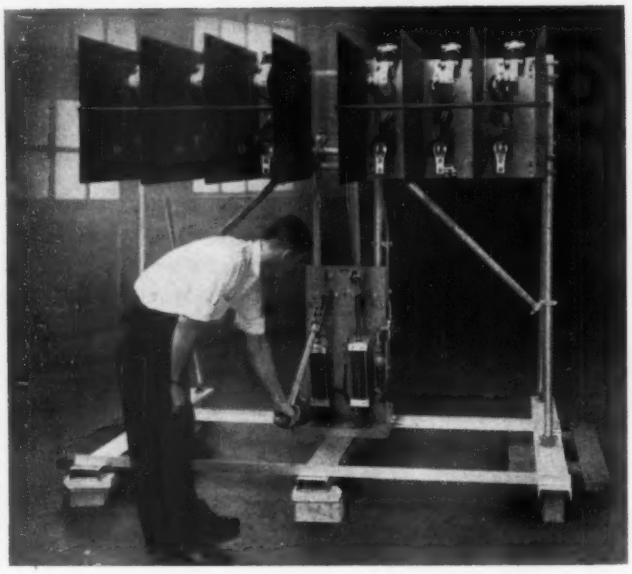
Whatever your pipe suspension needs, Grinnell can supply them. Grinnell Company, 260 West Exchange Street, Providence 1, Rhode Island.

Patents Applied For

GRINNELL

BRANCH WAREHOUSES AND DISTRIBUTORS IN PRINCIPAL CITIES

Procurement & Products



Automatic Switch . . .

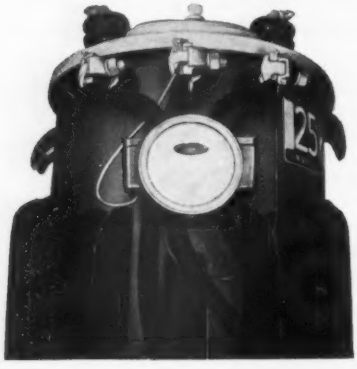
. . . **transfer mechanism** has been developed with a dual cylinder activated by stored energy. When a power failure occurs, the mechanism opens the preferred source disconnect switch and closes another, transferring to an emergency power source. Loss of preferred source voltage activates the cylinder for the preferred switch. When the preferred switch opens, a signal is relayed to a second cylinder to close the emergency switch and cut in the emergency power source without interruption of service.

Delta-Star Electric Div, H. K. Porter Co, Inc, 2437 Fulton St, Chicago 12, Ill.

Load Indicator . . .

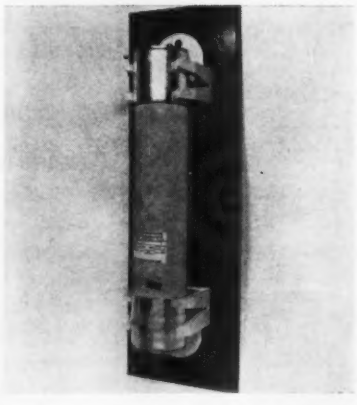
. . . **for distribution transformers,** 25-kva, new or existing, can be mounted and connected outside the transformer tank. Known as type TL, it makes selective monitoring of loads across an entire system possible. Load level may be adjusted in the field. Basically a signal light demand-type meter modified to follow the effect of ambient temperature on the transformer, it bypasses momentary peaks caused by faults, but responds to larger overload peaks. Load indicators for 5 through 50 kva transformers will be made available.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

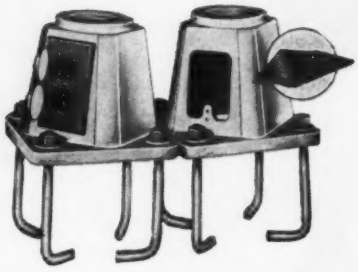


Current Limiting Fuse . . .

. . . **features reduced thermal and magnetic stresses,** minimizing possible danger to other equipment. The fuses (Type FM), in ratings of 2,400 to 4,800 v, are totally enclosed, sand-filled and provide self-contained interruption. A mechanical indicator projecting from the fuse's lower end is operated by a mechanism, separate from the elements, which releases the indicator after the fuse has blown. These fuses are for motor controller use.



Allis-Chalmers Mfg Co, Milwaukee 1, Wis.



Aluminum Pole Base . . .

. . . **is threaded for 2-in., 2½-in.,** and 3-in. pipe sizes. It is used for medium-sized outdoor lighting applications such as driveways, walkways, commercial entranceways and recreational areas. Anchor bolts and mounting template are included, as is an accessible grounding screw.

Moldcast Mfg Co, Dept PB-15, 236 South St, Newark 5, N. J.

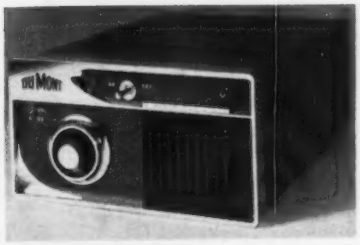
Backhoe Attachment . . .

. . . **has positive pressure feature** to assist in digging in rock or frozen ground. The operator can use almost the entire weight of the machine when digging. A one-way hydraulic cylinder is fastened at the top of the mast, and the cylinder

Aerial Ladder . . .

. . . features simplified design which reduces initial cost, installation expense, and upkeep. Elevation of the unit (Series HLE) is actuated by a hydraulic cylinder which is powered by an electric motor-driven pump. Operated by the truck battery, the motor works with either 6 or 12-v chassis electric systems. Use of an electric motor eliminates the power take-off normally required when hydraulic power is used on ladder equipment. The ground-to-working platform heights of the sizes available are 27 ft, 31 ft, 35 ft and 40 ft. **McCabe-Powers Body Co, 5900 N Broadway, St. Louis 15, Mo.**

piston is secured to the backhoe boom. In operation, the cylinder acts as a solid connection between the boom and the mast or back stay. Nearly the entire machine has to be lifted to force the boom upward. **American Hoist & Derrick Co, 63 S Robert St, St. Paul 7, Minn.**



Mobile Radio . . .

. . . has reduced maintenance. The Transicom (Type MCA 325), a transmitter/receiver unit mounted under dashboard, operates in the 144-174 mc band with transmitter ratings of 10, 20, and 30 w. Dual frequency transmitters and coded squelch are optional. **Allen B. Du Mont Laboratories, Inc, 750 Bloomfield Ave, Clifton, N. J.**

More New Products

Ultrasonic cleaner for average energy applications has 2-gal tank. Model 120 operates on 115-v, ac and delivers an average output of 125 w.—National Ultrasonic Corp, 111 Montgomery Ave, Irvington, N. J.

Armature banding **tape,** made from Fiberglas and a high temperature polyester resin, can be used on all sizes from fractional horsepower to 5,000 hp. It is known as XR-14.—Pittsburgh Electrical Insulation Co, Pittsburgh, Pa.

Aluminum **roof coating** becomes brighter with the passing of time. The asphalt-based coating is used to renovate old roofs.—Barrett Div, Allied Chemical Corp, 40 Rector St, New York 6, N. Y.

Readers Service

For additional information on new products, supplies, and services in this issue, the Manufacturers Editor of Electrical World offers his facilities. Check items in which you are interested in list below.

NEW EQUIPMENT

Delta-Star .....Switch ☐
McCabe-Powers .....Ladder ☐
Westinghouse .....Indicator ☐
Allis-Chalmers .....Fuse ☐
Moldcast .....Pole Base ☐
American Hoist .....Backhoe ☐
DuMont .....Radio ☑

OTHER

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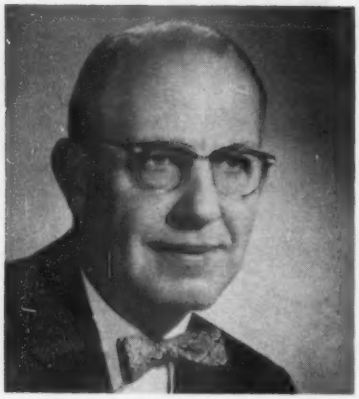
Manufacturers Editor
Electrical World
330 W. 42nd St.
New York 36, N.Y.

* **Note: Requests must be received within four weeks of publication date, accompanied by complete information specified. This service cannot be offered to readers in foreign countries or to competitive manufacturers.**

NAME_____
TITLE_____
DEPT._____
COMPANY_____
ADDRESS_____

FOR:
Reference ..... ☐
Specs ..... ☐
Trial ..... ☐
Purchase ..... ☐

FEBRUARY 1, 1960



Markley Named Financial VP

F. H. Markley has been named financial vice president of Pennsylvania Power & Light Co, succeeding A. D. Root who retired.

Markley has been with the utility for 35 years. Joining the company in 1925, he held accounting and auditing positions in the company's financial organization before being named assistant treasurer in April, 1946.

He was named treasurer in 1952 and served in that post until being appointed assistant vice president, financial, in October, 1957. He held this title until his recent promotion to financial vice president.

Root had been with PP&L since 1945 and before that was with the Electric Bond & Share Co and Ebasco.

West Penn Makes Rice Chief Executive

West Penn Electric Co has named President J. Lee Rice Jr to become the chief executive officer. He succeeds Earle S. Thompson who continues as chairman of the board.

Rice was elected president and designated chief administrative officer in 1957. He had been treasurer of West Penn and its predecessor, American Water Works & Electric Co, since 1945.

He entered the utility business in 1925 upon graduation from the Wharton School at University of Pennsylvania.

Thompson joined the American Water Works & Electric Co in 1923. He was elected president in 1937 and later became president and chairman of West Penn.

Anaconda Promotes Four to New Vice Presidential Posts

ALLEN BENTON VAN VALKENBURG TINDALE

Anaconda Wire & Cable Co has made the following changes: David E. Allen has been named executive vice president; William H. Benton Jr, vice president-manufacturing; John L. Tindale, vice president-marketing and sales; and Henry V .Van Valkenburg, vice president and general sales manager.

Allen, who was vice president-sales, succeeds Richard B. Steinmetz who was elected president of Anaconda last October. Allen joined Anaconda in 1932 and was general sales manager from 1952-1954.

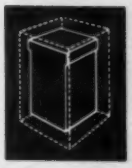
Benton, formerly general manager of mills, succeeds Vito F. Di Lustro who will retire this year.

Tindale was formerly commercial vice president, and Van Valkenburg was most recently general sales manager. Tindale has been with Anaconda since 1936, and Van Valkenburg since 1931.

(*More News About People on p* 74)

all new! **gould** *stationary batteries in plastrite jars!*

SAVES 30 TO 40% FLOOR SPACE. You can increase your battery room capacity without increasing the room size just by installing new Gould Batteries in Plastrite Jars.



EASIER TO HANDLE. You will find it easier and quicker to move batteries in your battery room; shipping and handling costs are lower because of the reduced weight of these new batteries.

NEW PLASTRITE JARS NEVER LOSE SHAPE . . . never bulge or warp because Plastrite has 15 to 30% higher resistance to heat distortion and 50% higher elongation characteristics than other stationary battery jars.

HIGHER IMPACT RESISTANCE, TOO. Normal handling shocks and shipping abuse will not harm the new Plastrite Jar which has a higher tensile strength.

Defies electrolyte seepage. New Silicone O-ring post seal expands under compression, forming a tight seal against the cover wall of the battery. This prevents escape of electrolyte, eliminates discoloration of battery cover.

New stronger posts assure full current-carrying capacity, permit convenient assembling of cells end-to-end or side-to-side.

New element suspension eliminates cover breakage due to weight of battery element.

Take advantage of the benefits offered by Gould's new Stationary Batteries in Plastrite Jars. They're available in Planté, Calcium, and Kathanode types . . . in capacities for every need. Write today for new illustrated catalogs, or call your local Gould office listed under "Batteries—Industrial" in the "Yellow Pages." Gould-National Batteries, Inc., Trenton 7, N. J. In Canada, write to Gould-National Batteries of Canada, Ltd., 1819 Yonge Street, Toronto, Ontario.

More Power to you from **gould**

We're busy as a one-armed paper hanger—making

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but we will never compromise with quality

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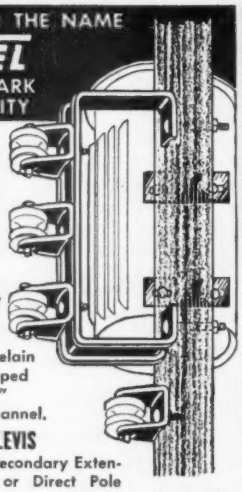
SWITCHBOARD & DEVICES CO.
CANTON, OHIO
A subsidiary of
The Union Metal Manufacturing Company

Socket Equipment • Test Switches • Test Blocks • Enclosures

LOOK FOR THE NAME
THIEL
IT'S A MARK OF QUALITY



SECONDARY EXTENSION BRACKET
Keeps wires clear of transformers. Complies with regulations. Sets Secondary Bracket out from pole to center of porcelain 12½". Hot dipped 2" x 3/16" x 3/16" galvanized channel.

SECONDARY CLEVIS
For use with Secondary Extension Bracket or Direct Pole mounting 4" center at hole to back of bracket. 3/16" x 3" hot dipped galvanized with or without insulator.

Transformer Adaptor Plates For Direct Pole Mounting

Now! All type O.S. Transformers can be mounted directly to the pole with two thru bolts. Cross bar and channel function are welded all around. All hangers, kickers and adapter plates are hot dipped galvanized. Furnished complete with hot dipped galvanized bolts.

THIEL TOOL & ENGINEERING CO., INC.
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MINERALLAC
"PULL-IN"
COMPOUND
No. 100

LISTED and APPROVED by UNDERWRITERS LABORATORIES

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Approved by Underwriters Laboratories for lubricating wires and cables to facilitate pulling them into conduits. Not injurious to wire or wire covers. Free of objectionable odors. White in color. Will not drip or run. Convenient pint, quart, ½ gal., gal. and 5 gal. cans. Available through your electrical jobber.

MINERALLAC ELECTRIC COMPANY
25 North Peoria Street, Chicago 7, Illinois

MINERALLAC

PERSONAL BRIEFS

William Reid Thompson joined the legal staff of Carolina Power & Light Co recently. He was a Superior Court Judge.

C. Howard Johnson has been appointed public utilities director for the city of Columbus, Ohio.

Union Electric Co names: **E. Dennis O'Neill** sales planning assistant in residential sales; **Kenneth E. Hanley** senior assistant relay engineer in transmission and distribution operating and **Walter R. Parker,** superintendent of the Ashley Plant.

N. Bruce Cox, Fieldale district manager of Appalachian Power Co, retired recently. He was succeeded by **E. L. Munday Jr.**

American Electric Power Corp has elected **James B. Berg** an assistant treasurer.

J. H. Welch Jr has been made manager of Duke Power Co's Lenoir branch, succeeding **J. H. Robertson,** retired.

Robert Aschenbrenner has been named to the newly created position of power engineer for the Grant County Public Utility District, Ephrata, Wash.

Carl D. Mullican has become director of the middle south area office of Mississippi Power & Light Co. **Alex McKeigney** has become director of advertising and sales promotion.

General Electric Co has named **Robert B. Ames** manager of marketing in Rome, Ga., medium transformer dept. Other changes: **Paul D. Williams** has become manager of marketing administration for the communication products dept; **J. B. Land** has been appointed industrial sales manager, Cincinnati office of Apparatus Sales Division; **Charles J. Meloun** has been named manager of marketing for outdoor lighting dept; **Wray H. Reger** has been given the new post of communications consultant for the manufacturing laboratory equipment operation.

Widely used on

- Insulator pins
- Crossarm bolts and braces
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- **Eliminate radio interference due to loose hardware**

Every bolt - and - nut assembly locked with PALNUT Lock Nuts stays tight, despite weather, wind, stress and vibration. PALNUTS, tightened on top of the regular nuts, prevent loosening and falling off. Very low in cost—easily, speedily applied — require little space — may be used on new or existing assemblies. Hot dip galvanized, silicon bronze and other materials and finishes. Stocked by all leading pole line hardware manuacturers.

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51 Glen Road
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N. J.

PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

Line Has Light Towers

(*Continued from page* 39)

"raise" or "lower" buttons. Each telemetering functions (Mw, Mvar and kw) is sampled on a cyclic basis, and the telemeter receiver is synchronized in such a way that the meters display a continuous reading.

To start the station under emergency conditions with the bus dead and no power available for auxiliaries, the diesel units are started first and then the synchronizer is cut out by the bypass switch on the panel. Each unit can then be started by turning the turbine switch on the control panel to "run" position and the starting sequence comes into operation. Stopping each unit, and opening or closing any main breakers, can be performed remotely by turning the appropriate switch on the Mimic diagram. The position of the switch shows clearly which are open, which closed. If the position of an actual breaker does not coincide with the control switch position on the Mimic diagram, an indicating light in the center of the switch will flash a warning.

Plant Self-Protecting

The plant is completely self-protecting. Although alarm indications are sent to the head office and are shown by warning lamps on the control panel, alarms are backed up by protective devices in the plant itself. Protection consists of:

1. Non-lockout shutdowns, initiated by devices which operate for faults of less serious nature, such as low cooling water pressure. These result only in tripping off the unit circuit breaker, although the gas turbine is kept running.

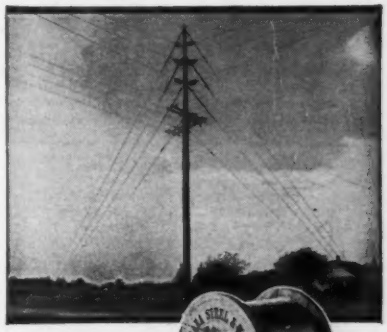
2. Lockout shutdowns, initiated by devices which operate for faults of more serious nature, such as a stator ground fault or high bearing temperatures. These, not usually self-correcting, require inspection by the mobile service crew before restarting the faulted unit.

Alarms transmitted to the head office indicate by warning light on the control panel that a maximum admissible value has been reached and that automatic shutdown of that unit may be expected shortly. This gives the supervisory control operator time to shift the load to other generators, before unit shutdown.

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.



Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

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STEEL & WIRE CO., INC., Muncie, Indiana

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AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.
EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

$1.80 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

PROPOSALS, $1.80 a line an insertion.
BOX NUMBERS count as one time additional in undisplayed ads.

DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

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Bring You HIGH SPEED In 6x6's!

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REO "EAGER BEAVER"

LOW, LOW PRICES! GUARANTEED!
TROUBLE-FREE! IN CURRENT OPERATION
BY ARMY AND NATIONAL GUARD UNITS!

• Complete Parts Stock! • Immediate Delivery!

AT LAST—High Speed combined with power, outstanding performance, rugged get-up-and-go—bring you everything you've been looking for in a truck!

And what a selection! Whatever your job, here's the truck for you. **The rough and ready Mack! The powerful, rugged GMC! The outstanding Reo "Eager Beaver!"** Each model the latest, most advanced truck engineering available today—at prices so low it's hard to believe. All with steel cab kits.

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3—1500 KVA G-E 69000—2300Y
3—1500 KVA G-E 69000—2400/4160Y
3—1500 KVA G-E 69000—7200/12470Y
4—1000 KVA Mol 7200/12470Y—4160
3—500 KVA Penn. 13200—120/240
3—333 KVA G-E 66000—2400/4160Y
1—750/938 KVA G-E 3-Ph. 33000—6900Y—TCUL equip. fan cooling
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for large mfr. of equipment sold to Elec. Utilities. Line responsibility. Requires experience & extensive acquaintanceship with Elec. Utilities. Prefer man with EE degree. Base salary $20,000 plus extras.
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Personnel Consultants since 1921
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U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-5271) will be received at Denver, Colorado, until 2 p.m., Mountain Standard Time, March 8, 1960, for furnishing one 105,000-KVA, 3-phase, 230- to 15.75-KV, class FOW, outdoor power transformer for Hoover Powerplant, Boulder Canyon Project, Arizona-California-Nevada. Delivery is desired within 360 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver, Colorado. Floyd E. Dominy, Commissioner.

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Wanted—Electrical Engineers. Minimum five years experience in Public Utility Distribution, Transmission, Metering and Relaying. Required for permanent, responsible positions in Venezuela. Spanish an asset but not essential. Good living conditions. Starting salary of $13,000 per annum. P-3537, Electrical World.

Electrical Engineer — Graduate Electrical Engineer with minimum of five years experience in operation and construction of overhead and underground electric utility systems. Experience should include work with transmission lines, distribution lines and substations. Some relay experience desired. Position is with medium sized consulting engineering firm located near Denver, Colorado. Work assignments varied and typical of small rapidly growing utilities. Opportunities for advancement. Send complete resume of past experiences to: Miner and Miner, Consulting Engineers, Inc., 5598 South Broadway, Littleton, Colorado.

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Representative wanted for manufacturer of street lighting equipment pole line specialties. Full particulars. RW-9821, Electrical World.

POSITION WANTED

Elecrical Engineer extensive experience in both public and private electric utility fields including engineering, design, purchasing, and managerial. Licensed in two states. Presently employed but desire to relocate. PW-3547, Electrical World.

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MR. EMPLOYER, won't you remove the mystery about the status of an employee's application by acknowledging all applicants and not just the promising candidates.

MR. EMPLOYEE you, too, can help by acknowledging applications and job offers. This would encourage more companies to answer position wanted ads in this section.

We make this suggestion in a spirit of helpful cooperation between employers and employees.

This section will be the more useful to all as a result of this consideration.

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The Meetings Calendar

FEBRUARY

National Electrical Week—Feb. 7-13.

Missouri Valley Electric Association—Industrial & Commercial Sales Conference, President Hotel, Kansas City, Feb. 8-9.

Pennsylvania Electric Association—Joint Meeting of Relay & Communications Committee, Hotel Bellevue-Stratford, Philadelphia, Pa., Feb. 11-12; System Planning Committee, Hotel Pittsburgh-Hilton, Pittsburgh, Pa. Feb. 15-16; Residential Committee, Philadelphia, Pa., Feb. 15-16; Motor Transportation, Johnstown, Pa., Feb. 18-19; General & Customer Accounting, Pittsburgh Airport, Pittsburgh, Pa., Feb. 18-19; Prime Movers Committee, Hotel Bellevue-Stratford, Philadelphia, Pa., Feb. 18-19; Commercial Committee, Pittsburgh, Pa., Feb. 24-25; Taxation Committee, Pittsburgh, Pa., Feb. 25-26.

American Institute of Mining, Metallurgical and Petroleum Engineers—Annual Meeting, Hotel Statler, N. Y., Feb. 14-18.

Edison Electric Institute—Electrical System & Equipment Committee, Bellevue-Stratford Hotel, Philadelphia, Pa., Feb. 15-16; EEI-AGA Accounting Conference Final Working Meeting, Sheraton-Cadillac Hotel, Detroit, Mich., Feb. 15-16; Commercial Cooking & Water Heating Committee, Atlanta, Ga., Feb. 18-19; Sales Personnel & Training Committee, New York City, Feb. 18-19; Residential Electric Heating & Air Conditioning Committee, New York City, Feb. 29-March 1.

American Public Power Association—Engineering & Operations Workshop, Town House, Kansas City, Kan., Feb. 17-19.

American Marketing Association—Sixth Annual Public Utilities Seminar, Chase Hotel, St. Louis, Mo., Feb. 18-19.

National Society of Professional Engineers—Winter Meeting, Broadview Hotel, Wichita, Kan., Feb. 18-20.

National Rural Electric Cooperative Association — Annual Meeting, St. Louis, Mo., Feb. 22-25.

California Municipal Utilities Association—Annual Conference, Miramar Hotel, Santa Monica, Calif., Feb. 23-26.

Sixteenth Annual National Wiring Sales Conference—Warwick Hotel, Philadelphia, Pa., Feb. 25-26.

Pacific Coast Electrical Association—Business Development Meeting, Hotel Lafayette, Long Beach, Calif., Feb. 29-March 1.

MARCH

Southern Safety Conference—Robert Meyer & George Washington Hotels, Jacksonville, Fla., March 6-8.

American Society of Mechanical Engineers—Gas Turbine Power Division & Hydraulic Division, Rice Hotel, Houston, Tex., March 6-9.

• **Fifth National Electrical Industries Show**—New York Coliseum, New York City, March 6-9.

• **Southeastern Electric Exchange**—Accident Prevention Committee Joint Meeting with Personnel Administration Section, King Edward Hotel, Jackson, Miss., March 10-11; Annual Conference, Boca Raton Hotel & Club, Boca Raton, Fla., March 21-23; Directors Meeting, Boca Raton Hotel & Club, Boca Raton, Fla., March 23.

• **Pennsylvania Electric Association**—Purchasing Committee, Philadelphia, Pa., March 14; Customer Contact Committee, Pittsburgh, Pa., March 16; Street & Highway Lighting Committee, Pittsburgh, Pa., March 17; Personnel Practices, Philadelphia, Pa., March 24.

• **National Association of Corrosion Engineers**—16th Annual Conference and 1960 Corrosion Show, Memorial Auditorium, Dallas, Tex., March 14-18.

• **National Electrical Manufacturers Association**—First National Electric House Heating Exposition, Sherman Hotel, Chicago, Ill., March 21-23.

• **Canadian Electrical Association**—Western Zone, MacDonald Hotel, Edmonton, Alberta, Canada, March 21-23.

• **Institute of Radio Engineers**—National Convention, Coliseum & Waldorf-Astoria Hotel, New York City, March 21-24.

• **Oklahoma Utilities Association**—Accounting Section, Biltmore Hotel, Oklahoma City, March 23; Association Convention, Biltmore Hotel, Oklahoma City, March 24-25.

• **Electrical Industry Show and Lighting Exposition**—Sponsored by the Electrical Maintenance Engineers Association of Southern California, Shrine Exposition Hall, Los Angeles, Calif., March 23-26.

• **American Power Conference**—22nd Annual Meeting, Sherman Hotel, Chicago, Ill., March 29-31.

• **Edison Electric Institute**—Area Development Committee, Atlantic City, N. J., March 31.

• Additions this week.

Advertising Index

Allis-Chalmers Mfg. Co.....22, 23
Blackburn Corp., Jasper..... 21
Brown Boveri Corp..... 20
Burndy Corp. .....2nd Cover
Directory of Engineers 77
Engineers, Directory of..... 77
Exide Industrial Div., The Electric Storage Battery Co 3rd Cover
Federal Pacific Electric Co..... 10
General Electric Co.
Apparatus Dept..6, 7, 44, 45, 47, 48, 49
Medallion Homes 52, 53
Goodrich Chemical Co., B. F. 19
Gould-National Batteries, Inc..... 73
Grinnell Co. 68, 69
Indiana Steel & Wire Co., Inc..... 75
Kuhlman Electric Co.....4th Cover
Lapp Insulator Co., Inc.....24, 25
Line Material Industries..... 26
Mineralac Electric Co..... 74
Ohio Brass Co.....15, 16, 17, 18
Okonite Co. 4
Palnut Company 75
Pennsylvania Transformer Div., McGraw-Edison Co. 55
Philadelphia Electrical & Mfg. Co.... 57
RT&E Corp. 51
Roebling's Sons Corp., John A..... 65
Searchlight Section 76
Simplex Wire & Cable Co..... 58
Superior Switchboard & Devices Co.. 74
Thiel Tool & Engineering Co., Inc... 74
Thompson-Ramo-Wooldridge Products Co. 67
United States Rubber Co.....8, 9
PROFESSIONAL SERVICES..... 77
CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.
EMPLOYMENT OPPORTUNITIES..... 76
EQUIPMENT (Used or Surplus New) For Sale 76

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